SCIENTIFIC AMERICAN

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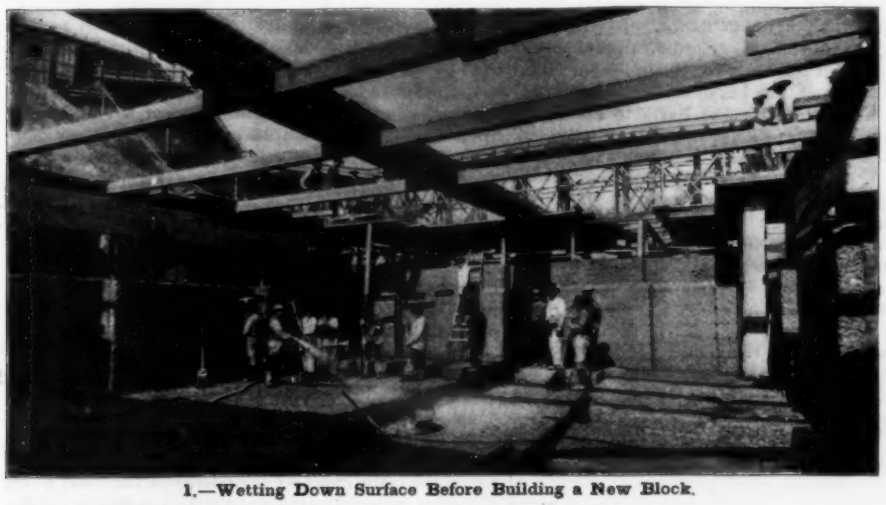
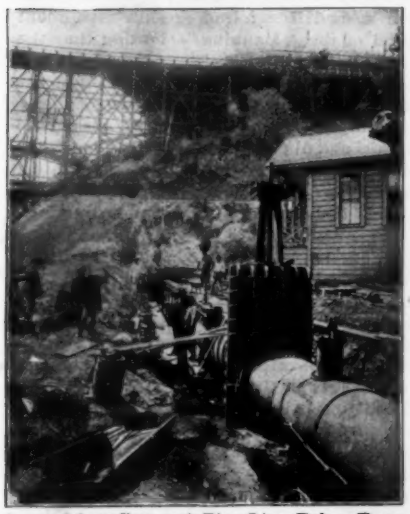
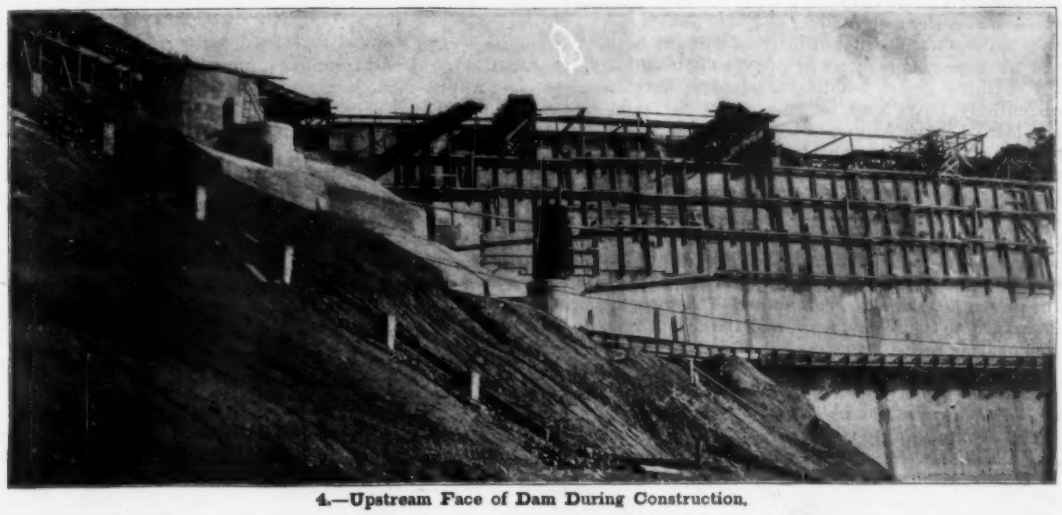


1.—Wetting Down Surface Before Building a New Block.

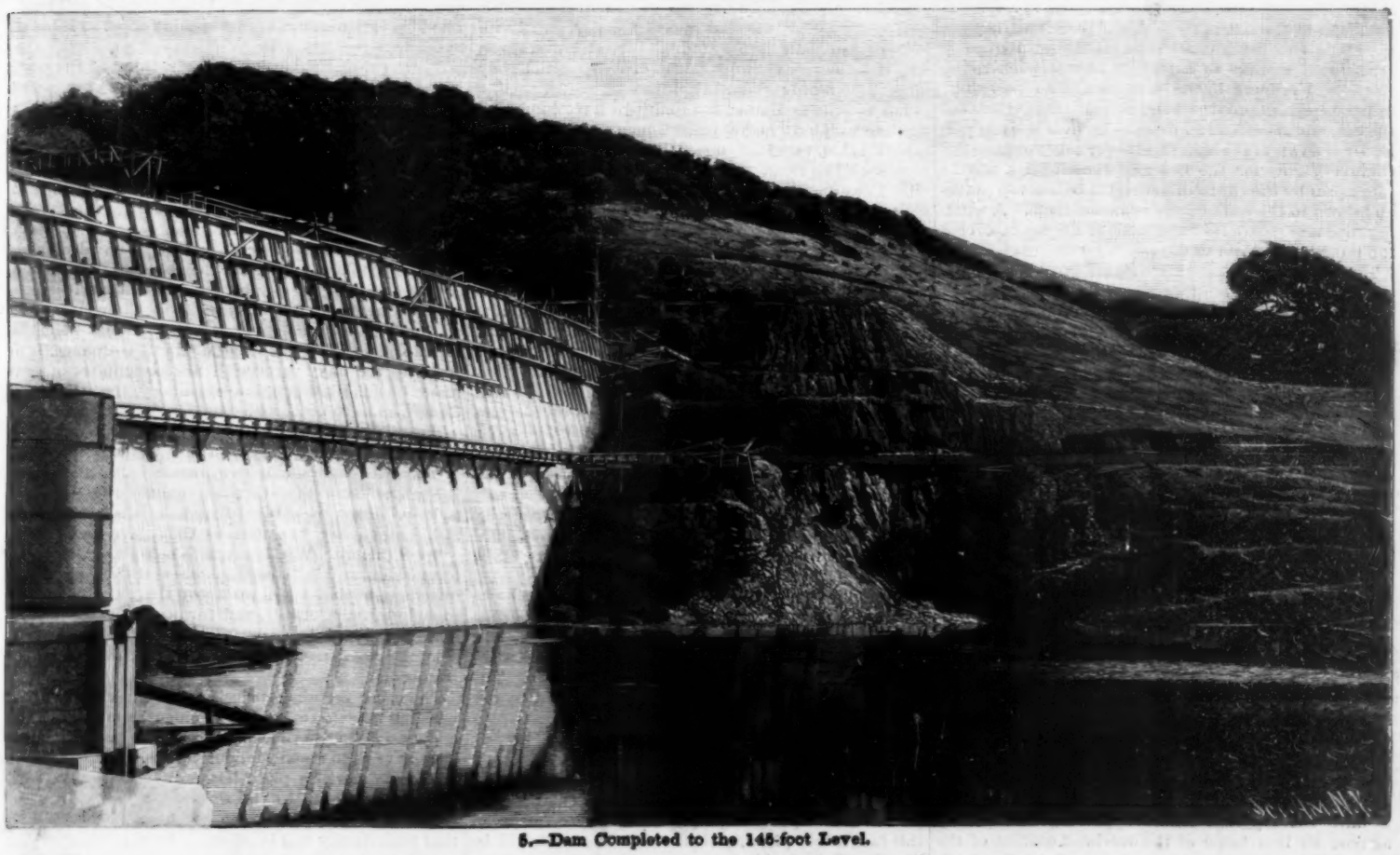
2.—Crest of Dam, Showing Method of Dovetailing the Blocks.



3.—A 4-foot Gate and Pipe-Line Below Dam.



4.—Upstream Face of Dam During Construction.



5.—Dam Completed to the 145-foot Level.

CONSTRUCTION OF THE CRYSTAL SPRINGS DAM, CALIFORNIA.—[See page 392.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 17, 1898.

UNSUSPECTED PERIL IN ELEVATORS.

The recent shocking elevator accident in the United States Fire Insurance Company's building, William Street, New York, which resulted in the death of the secretary of the company, Walter H. Griffin, the serious injury of Thomas W. Cauldwell, a director, and minor injuries to the other occupants of the car, has opened the eyes of the public to an unsuspected but very grave peril in one of the most common forms of elevator.

Since the epidemic of elevator accidents which visited this city last year, when such noted structures as the American Tract Society building, the Waldorf-Astoria Hotel, and the General Post Office were the scenes of more or less serious breakdowns, New York has been comparatively free from disasters of this kind. The accidents of that period were of such a nature that the cause was easily ascertained, and the lessons which were learned have been put to good account by both the builders and operators of this class of machinery.

The United States building accident, however, is of an entirely novel kind, nothing like it, as far as we can learn, having happened before. It has served to show that there are some contingencies that may escape the most careful safeguarding against accident, and it teaches us that in elevator-work involving the constant movement of heavy suspended weights through vertical distances measured by the hundreds of feet, it is well to provide even against those breakdowns which are apparently, in the nature of things, impossible. In the present case the car containing eight people had descended to the ground floor, and the occupants were commencing to leave the car, when several 100-pound weights became detached from the counterbalance cage at the top of the shaft and fell through the full height of eleven stories upon the roof of the car.

The elevator is of the Otis overbalanced electric type, so named because the weight of the car is overbalanced by counterweights, which are attached to the car by wire ropes that pass over pulleys located at the top of the shaft. The counterbalance weights travel in a vertical guideway at the side of the elevator shaft, and they are placed in two cages or stirrups, placed one above the other, with a space of a foot or two between them. Each cage is hung by its own separate ropes. The upper cage contains the weights that counterbalance the car, and its ropes run directly up over the top pulleys and down to the car. The lower cage contains the counterweights for the live load (passengers), and its ropes pass by the car counterweights over a top pulley and down to the back of the winding drum. A winding rope also passes from the front of the drum, over a top pulley, and down to the car.

The object of the counterweights is to relieve the strain on the car hoisting ropes, due to the sudden starting and stopping. Thus we may state a typical case in which the empty car weighs 2,000 pounds and its counterweight acting on the car 1,500 pounds, while the live load provided for is 2,000 pounds, counterweighted by 1,500 pounds acting on the back of the winding drum. It is evident that the greatest deadweight to be overcome by the electric motor is never over 1,000 pounds. The motor, when the car is empty, will have to lift 1,000 pounds excess of counterweight, and when the car is full will have to lift 1,000 pounds excess of live load. In the normal condition of working, when the car is half full, the car and load will about balance the combined dead and live load counterweights.

The car is arrested at the top and bottom of the shaft by means of an automatic catch on the motor, which switches off the current at the proper moment. It seems that the catch was out of place by an amount equivalent to two or three feet of travel of the car; so that on this particular occasion, instead of the motor stopping when the car reached the bottom, it continued to wind up the lower case of weights, which, as we have stated above, was attached through its ropes to the drum. The lower cage was lifted in the groove until it struck the upper cage, which it carried up with it until the top edge of the upper cage brought up against an iron beam of the overhead grating of the shaft. The continued pull of the rope caused the lower cage to crush and bend open the vertical bars of the upper cage, thereby allowing the loose weights which it carried to fall out and down the shaft.

It should be explained that the cages consist of a solid top and bottom weight connected by two vertical rods. The space between these weights, which are fixed, is filled in with loose weights (used in adjusting the overbalance of the car), which are held in place by notches at their ends which embrace the two vertical rods, above mentioned, of the carriage. The vertical rods were only expected to be subjected to a tensional strain, and sprung open at once when they were compressed between the upper grating and the lower car acting under the pull of the motor.

This is the first instance on record of an accident of this character, and it teaches a very plain lesson, which the makers, not only of this, but of all forms of counterbalanced elevators, should make haste to act upon. The counterweight cages should at once be changed so as to render the spilling of the loose weights an impossibility. Either a bolt should pass down through every weight or the cage should be made of stout sheet iron or wire netting. Although it has taken nearly a score of years to reveal the existence of this peril, the terrible consequences of such an accident render it the duty of every maker and owner of such elevators to make the slight changes which are necessary to safeguard the public in future.

It is needless to say that the accident emphasizes the necessity for frequent and rigid inspection; for it was the misplaced automatic stop that was the immediate cause of the disaster.

FORTHCOMING IMPROVEMENTS IN UNITED STATES NAVAL ORDNANCE.

The present fiscal year, 1898-99 promises to be an unusually important one in ordnance development in the United States navy. As a result of the reports received from the various ships which were actually engaged in battle during the past summer, a number of important changes will be made in guns and mounts and in the make-up of the ships' batteries. The 13-inch gun will give place to an improved type of 12-inch gun as the main armament of battleships, and a more powerful 6-inch gun will become the standard weapon for the arming of the main rapid-fire batteries. The 12-inch gun will be a weapon of much greater power than the present type, as installed on the "Iowa," and there is good reason to believe that the wire-wound system, which is in very successful use in the British navy, will be used in this and in the 6-inch gun. For the present, however, it is premature to announce the use of this system as a settled fact. The new 6-inch gun will have a velocity of 3,000 feet per second. This enhanced velocity will be effected by an increase in weight and length, but no change will be made in the present specifications for projectiles. The other conspicuous change will be the general substitution of 3-pounder guns on the heavier ships for 1-pounders. The 3-pounders may even be expected to largely displace 6-pounders, particularly on the smaller vessels. It is not generally known that the 3-pounder gun has a longer range than the 6-pounder. It is a fact, however, which is due to the employment of a proportionately larger amount of powder behind the 3-pounder shell.

The actions at Manila and Santiago have confirmed the lessons taught at Yalu that 1-pounder guns have a questionable value on board battleships and heavy cruisers. The range of these guns is deemed too limited. The action at Santiago was fought out at ranges, generally speaking, beyond 3,200 yards. The 1-pounder guns have their sight bars cut for only 3,000 yards.

The demand just now is for heavier guns in the secondary batteries of battleships, and in the United States navy provision is being made to supply pieces of 12-pounder and 14-pounder calibers. The 12-pounder was adopted several years ago in the British navy and is a favorite weapon. It not only finds a place in the batteries of battleships and heavy cruisers of that service, but is mounted on vessels of the torpedo-boat destroyer class. The battery arrangement on this last mentioned class is one 12-pounder and four 6-pounder guns. The United States destroyers of the Porter type, mounting four 1-pounder guns, make a rather light showing in comparison.

The new 14-pounder gun will have a muzzle velocity of 3,000 foot-seconds. For small vessels of too light construction to mount 4-inch guns in the extremities, the new 14-pounder is deemed an ideal weapon.

Assurance is given from a high quarter that all secondary battery guns for the United States navy of the 3-pounder and 6-pounder types will hereafter be built on the semi-automatic principle. The Maxim-Nordenfelt mechanism appears to be the type hit upon. The right to use this principle has been acquired by our naval authorities.

The manufacture of projectiles for secondary battery guns has been carried to that point where there is little difference in the cost of common shell and armor-piercing shell. This statement applies particularly to 3-pounder and 6-pounder projectiles. In consequence of this fact, armor-piercing shell, it is announced, will be issued exclusively from now on for the lighter calibers. The armor-piercing projectiles in calibers below the 4-inch carry explosive charges.

The Maxim-Nordenfelt automatic guns, which were installed in large numbers on board United States ships at the breaking out of the war, did good service, but, from the individual reports of officers, there were a good many instances of jamming at the outset. When the volute springs were well set up and the cartridge cases properly squared, the guns could generally be depended upon to run a belt out without stop, but there was more than one instance of cartridge cases pulling apart from the shells. The ammunition used was of English make, and the opinion has been quite freely expressed that in manufacture it was not up to the best American make. As a prominent ordnance official has expressed it, however, "When these guns did work well, they were ideal." The policy now is to make the 1-pounder guns of longer barrel and heavier. A rate of fire of 250 shots per minute is counted upon.

While foreign nations are employing high explosives to a large extent in naval shells, the policy in this country appears to be in favor of the retention of black powder charges. The latter can be depended upon to fire woodwork, and the action of one of these shells when bursting between decks is more diffusent than in the case of a high explosive charge. It was the black powder in the American shells which so early in the fight at Santiago set the Spanish ships on fire.

The reports from the various ships show that premature explosion of shells in the guns was not an infrequent occurrence during the war. The 5-inch gun of one vessel is said to have been badly scored by one of these happenings. On the "Manning" there were two instances of premature explosions in action, one a 4-inch shell, the other a 6-pounder, but the guns were not even marked. In squadron action before Santa Cruz del Sur a shell from a leading ship burst about 100 feet ahead of the "Manning," showing that the trouble in Commander Todd's fleet was not confined to one vessel. On the other hand, the action of the shells on striking on shore was not, according to later discoveries, always certain. Shells were picked up both at Daiquiri and about Santiago which had failed to detonate. In the case of the Maxim ammunition, the shells would often explode on striking the water. The "Manning" had occasion, when attached to Commander Todd's squadron, to use her Maxims on some thatched huts in the vicinity of Niquero, and it was found that the shells exploded with regularity, even when brought up by these light obstructions.

The attention of the ordnance officials has of late been directed to insuring a greater certainty of action in the fuses of all naval shells, and information at hand is, in effect, that the new fuses are more sensitive, while still possessing a good factor of safety. The trouble occasioned by shells exploding prematurely is ascribed to the doing away with burster bags. So long as the interior of the shell is given a smooth, lacquered surface, these accidents will doubtless be obviated. The rule now is to crowd as much black powder into a projectile as its interior space will hold. The idea is to obtain as great a mine effect as is possible.

Brown prismatic powder is now a thing of the past. Large contracts for the new smokeless powder are at present being filled, and it is confidently asserted in ordnance circles that there will soon be a sufficient supply on hand to fit out every ship in service. It takes at least one month to commence the delivery of smokeless powder, once a contract has been signed, and in these days of quick wars it is imperative to have a large reserve stock on hand.

The fear is expressed by many leading naval officials that the people will conclude that because this war was so easy, it will always be easy, and that it makes little difference what class of *materiel* the country has on hand or how much of it. The present policy of Commodore O'Neil, the Chief of Naval Ordnance, is to stock up the navy yards with liberal supplies of ordnance outfits; but as this costs money, the attitude of Congress has to be reckoned on.

The war with Spain has not only tended to ordnance changes, but to radical innovations in the preparation of ships for battle, and new regulations based upon the experiences of the past summer are promised shortly. From what can be learned, it is proposed to strip ships down hereafter as they have never been stripped before. Woodwork is to be torn out in ruthless fashion, and in those ships where the officers' living quarters are placed well up above the waterline, stateroom bulkheads, closets, and furniture are doomed to go. It is even a question if bunks will be retained. The recourse, in the event of taking out bunks, is hammocks.

There are certain articles carried on the decks of warships which are very convenient, such as chests and lockers, but in time of action these appurtenances only serve as so much fuel for flames. The new rule will be to mark in plain letters "Overboard" all fittings not essential to the working of a battery and which serve only to give off splinters. It is expected that opportunity will be afforded for ships to stow the greater part of their loose furnishings at the navy yards

before hostilities break out, but if vessels are brought to action without previous opportunity for preparation, the "overboard" practice will be in order.

The action at Santiago brought home more forcibly than any other battle the great danger from fire in time of battle, and forthcoming instructions, it is announced, will lay special stress on precautions to be taken. Not only must hose be led out to every part of a ship, but care must be taken to protect the hose as much as possible from destruction by shell. On several of the Spanish ships hose led along deck was cut to pieces by 6-pounder shell.

In the matter of carrying small boats in time of action, the naval authorities, it is understood, will leave it largely discretionary with the commanding officers, but the opinion is hazarded that naval captains, as a rule, will strip down to two or three boats. During the civil war the practice sprang up of dropping the small boats clear of the ship on going into action, and the same practice was observed to some extent in the Spanish war. On the larger vessels a steam cutter and a couple of pulling boats, say a whale boat and launch, constituted the outfit. It is contended that, in a prolonged artillery duel between ships, any boats carried in the cradles will be shot to pieces. There will be the danger arising from splinters, to say nothing of adding to combustible material. Even if the boats are not set on fire, they will probably be so badly damaged as to make it impossible to use them. The instructions, it is said, will suggest that commanding officers encourage their men to rely upon life preservers.

The war color for warships which most nearly approximates to the horizon and rocks has been found to be a dull gray, with a yellow shade. LIEUT. G. L. CARDEN,
Ordnance Officer, U. S. S. "Manning."

CHIEF CONSTRUCTOR PHILIP HICHBORN.

When we consider the brilliant naval victories of Manila Bay and Santiago, we are apt to forget the labors of those who made the success possible. The truth of the matter is that the victories were gained months and years previously in the draughting rooms in the State, War and Navy building at Washington. We do not wish to discount in any way the bravery and skill of the line and engineer officers who navigated and fought the ships with such success. At the same time the bureau chiefs and their subordinate officers who toiled all through the spring and early summer, buying new vessels, converting them from peaceful to warlike use, making and shipping supplies and attending to all of the manifold wants of an enormous fleet of 312 vessels, should not be forgotten. The good work accomplished by the Bureaus of Yards and Docks, Equipment, Navigation, Arms, Construction and Repair, and Steam Engineering, will ever remain one of the most pleasing and satisfactory remembrances of the war.

The subject of our sketch is Commodore Philip Hichborn, Chief Naval Constructor, U. S. N. A great deal of the hardest work which was done in the navy in the preparation of vessels for active service during the war was accomplished by the bureau over which Commodore Hichborn presides, and we have already, on another occasion, given an outline of the volume of work performed, and the results of the blockading fleets and the fighting speaks for the quality of work performed.

COMMODORE PHILIP HICHBORN, CHIEF NAVAL CONSTRUCTOR, U. S. N.

Commodore Philip Hichborn was born at Charlestown in 1839, and graduated from the Boston High School in 1855. He then entered French's Mercantile College and graduated from it in 1859. At the age of fifteen he acted as assistant secretary to Admiral T. H. Gregory, the commander of the Boston navy yard, and a year later he was indentured to the government as shipwright apprentice. During his apprenticeship of five years he successfully mastered every detail of the shipwright's trade, so that he has a knowledge of not only the modern, but the old system of shipbuilding. In recognition of his merit, Secretary Toucey ordered that he should receive a course of theoretical training, and he made remarkable progress in ship designing and calculations in another two years' course of theoretical training under Prof. Molle. In 1861 Mr. Hichborn obtained a position as carpenter of the clipper ship "Dashing Wave," bound for San Francisco. The voyage was a tedious and tempestuous one of some one hundred and fifty days. The third mate became ill, and Mr. Hichborn was required to act in his place, and he performed the duties of that officer with remarkable success. Upon arriving in San Francisco he worked for the Pacific Mail Company and the California Steam Navigation Company, and then once more entered into the employ of the government at Mare Island. He had various positions at this yard, and in 1862 was appointed master shipwright, which was a very responsible position for a man twenty-three years of age, for he had at times the direction of over one thousand men. Two years later he declined the position of Assistant Naval Constructor, but in 1869 he made application for appointment, and in May of the same year, after passing a severe examination, he was appointed as Assistant Naval Constructor, U. S. N., with the relative rank of Lieutenant. The training Mr. Hichborn had received in the yard and drawing office made the performance of his new duties comparatively easy. In 1870 he was sent to Portsmouth, N. H. A farewell ball and procession were given in his honor at Vallejo before he left. At Portsmouth Mr. Hichborn passed years of fruitful experience in building and repairing vessels. In 1875 he received his commission as Naval Constructor, having passed a competitive examination at the navy yard, in which he succeeded in distancing all his competitors. In December, 1875, he reported for duty at the Portsmouth navy yard. At this time the yard was being abandoned and the machinery stored and prepared to be transported to the new yard at League Island. A large share of this important work devolved upon Mr. Hichborn. He was always a strong advocate of the natural advantages of the island as a steel shipbuilding yard for the navy, and during the nine years he was on duty there he did all in his power to put it in condition for government work. He completed and repaired a large number of vessels at this yard.

In 1880 he was selected as a member of the first Advisory Board, from the organization of which was given the first impulse to naval reconstruction. In addition to his regular duties at the yard, he had charge of the completion of the "Terror" and "Amphitrite" and superintended the launching of these vessels. In 1884 he was selected by the Secretary of the Navy for special duty in Europe, and, in accordance with the orders of the department, made a tour of the dockyards of Europe, and upon his return he submitted a valuable report to the department, which is considered a standard work upon the subject. In November of the same year Mr. Hichborn was ordered to the Navy Department at Washington as assistant to the Chief of the Bureau of Construction and Repair, and also as Naval Constructor at the navy yard, Washington. He was also a member of the Board of Inspection and Survey. The duties of these very responsible positions, which he performed simultaneously, were rather trying, but his professional knowledge, sound judgment, and executive ability enabled him to perform the duty of these offices with great satisfaction to the department. Since his appointment as a member of the Advisory Board, in 1881, he has been prominently associated with matters affecting designing and construction of our new naval vessels. Mr. Hichborn was appointed Chief of the Bureau of Construction and Repair in September, 1893, and he now holds the relative rank of Commodore while he occupies this office. His position is comparable to that of the Chief of Naval Construction in England. He was reappointed for a second term on September 7, 1897. He redesigned the armorclad "Terror," converting her from a single turret monitor of doubtful utility into a double barbette turreted coast defense vessel of a very formidable type. These highly efficient barbette turrets were unanimously approved by the board of the Bureau Chiefs and have since been adopted for the "Amphitrite" and "Monadnock" and other vessels. Mr. Hichborn is a member of a number of societies devoted to the interest of shipbuilding, and he has devoted much time to literary work, chiefly upon subjects of a professional nature. His advocacy of sheathed ships is gaining in favor among men in the navy. He has also given great attention to life saving apparatus. His practical and inventive genius has contributed many valuable improvements in shipbuilding, such as the utilization of steel bitts as ventilators. In conclusion, it may be said that professionally Mr. Hichborn is always kind and sympathetic in his treatment of his subordinates and is ever ready to recognize their merit. He is a thorough master of his profession, and has won the respect and confidence of his men, and, without requesting it, he has at all times received the full measure of praise from the various Secretaries of the Navy as the result of his excellent management and executive ability.

GLAZED BOOK PAPER BAD FOR THE EYES.

The effect of glazed papers on the eyesight has recently occupied the attention of some German doctors. One authority examines the causes of the changes in the general reading and writing habits of the nation, and explains that in the earlier part of the century the old rag papers then in use, both for writing and printing purposes, were mostly of a dull gray or blue color, and were coarse-grained, so that thick letters had to be used by writers with quill pens or by printers on their old slow presses. With the introduction of more modern fibers, paper received a smoother surface, steel pens could be employed, and the printing paper could travel over quicker printing presses. The fashion for brilliant colors and elaborate typesetting has been carried to such a state of perfection that a reflection is often created which could never arise from the rougher surface. Now, what is the effect upon the reader's eye? In the old books or letters, with a mild and soothing light, the surface contrasted easily from the thicker and darker type or writing characters; now the highly glazed surface offers reflections of the light which, with the more elaborate and thinner type, produce a lot of shades and lights that are most trying to the eye. The paper has often to be turned in various directions to be seen more clearly in order to distinguish the gray (or, may be, other shades) of the type from the shining white of the paper. This is similar in effect as to the result of trying to decipher writing in the dusk. An experiment would soon prove this. Take an old edition, say, of Shakespeare, and a new magazine on highly glazed paper, and compare the sensation in the eye after half an hour's reading. The doctors, therefore, propose that the public inspectors of schools should order the use of sanitary paper for the eyes, by which they mean that a glazed or highly polished surface should be avoided, and the colors chosen should rather be gray or light blue, but no white, and in fact, no brilliant colors at all. The type should be clear and simple, and not too thin. The children, whose eyes require protection, and through them the parents, should be taught to demand their favorite books and papers to be printed in the right style, and the excesses of a falsely guided taste should be avoided. It is suggested that a few years of such policy would soon improve the eyesight.—Invention.

RADIOGRAPHY AND THE PHYSIOLOGY OF THE HEART.

M. Bouchard, at a recent meeting of the Academy of Sciences, reported some observations he had made upon the thoracic organs by means of the X-rays. Among other things he has been enabled to assert the existence of a marked dilatation of the auricles when the intra-thoracic blood-pressure is raised during inspiration. This condition is artificially brought about by endeavoring to inspire with the glottis shut, and is naturally brought about by the violent inspirations during a paroxysm of whooping-cough. M. Bouchard has also discovered that a clear horizontal space exists during forced inspiration between the shadow of the heart and that of the diaphragm, but during normal inspiration there is no space visible. This phenomenon, which is remarkable considering that the diaphragm and the pericardium are attached to one another, is explained by M. Bouchard in the following way. During the forced descent of the diaphragm in a large inspiration the inferior surface of the heart is in contact with the diaphragm to a very limited extent. The pericardium tucks itself into the space existing between itself and the heart, forming in front and behind a gutter into which in turn the pulmonary tissue is packed, thus forming a layer of tissue much more penetrable by the X-rays than those which make up the heart and the diaphragm.—Lancet.

A SIMPLE ELECTRIC BICYCLE-LAMP.

In most portable electric lamps the battery-cells used are placed one upon another, and two inclosing conducting casings are employed in completing the circuit between the battery-electrodes and the lamp terminals. A lamp made by the United States Battery Company, of 258 West Twenty-third Street, New York city, is an improvement upon this form, in so far as it uses but a single tubular casing which acts as a support for the lamp and its reflector, and as a conductor from one electrode of the inclosed battery to complete the circuit.

As shown in Fig. 1, the tubular casing in question is provided with screw caps at each end, and with an insulated lining surrounding storage battery cells placed one over the other. The cells are each provided with a cylindrical copper casing constituting a negative electrode, and with a projecting button constituting a positive electrode. The upper negative electrode is in electrical contact with the lower positive electrode. The lower negative electrode is in contact with the outer casing. An incandescent lamp and reflector are secured within a metal ring surrounding the tubular casing. A screw-threaded knob is secured to the upper cap and is provided with an insulating washer.

By screwing the knob down to its lowermost position, the washer will press a strip of copper down upon the upper positive electrode and thus cause a current to pass through this upper electrode, the copper strip, the inner terminal of the lamp, the outer terminal of the lamp, through the metal ring, the tubular casing, to the outer casing of the lower cell, and finally to the starting point, thereby causing the lamp to give a brilliant light.

In the accompanying engravings various forms of this portable lamp have been shown, in which forms the principle of construction and operation remain in the main unchanged.

Among the merits of this lamp may be mentioned its compactness, its simplicity of construction, and its cheapness. The storage battery cells used can be readily obtained in the numerous electrical and bicycle supply stores of every city.

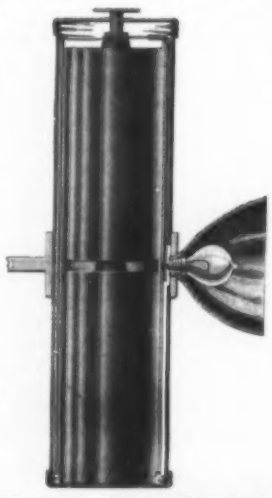


Fig. 1.—An Electric Bicycle-lamp in Partial Section.

Fig. 2.—An Electric House-lamp.

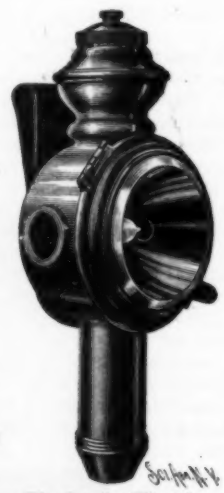


Fig. 3.—An Electric Carriage-lamp.

VARIOUS FORMS OF A SIMPLE ELECTRIC LAMP.

HIGH SPEED ATTAINED BY THE "FARRAGUT."

The twin screw torpedo boat destroyer "Farragut," authorized by act of Congress June 10, 1896, and the contract signed by the Union Iron Works for her construction October 6 the same year, received her official trial on November 11, and is reported as having developed extraordinary speed. On the builders' preliminary trial trip of November 8 the "Farragut" made 31·76 knots under 404 revolutions of her propellers. The official figures are said to slightly exceed this achievement.

The Secretary of the Navy received a telegram on December 3 from Lieutenant-Commander F. J. Drake, president of the board appointed to conduct the trial of the torpedo boat "Farragut" in San Francisco Bay, as follows:

"'Farragut' made successful trial run of one hour with one turn. Average revolutions, 419$\frac{5}{10}$ per minute. Everything worked smoothly."

The Union Iron Works, builders of the vessel, telegraphed to the Secretary as follows:

"'Farragut' made successful run yesterday. Speed, 30·18 knots."

Under the contract the "Farragut" was required to make 30 knots, and naval officials are greatly pleased to hear that she exceeded the requirement.

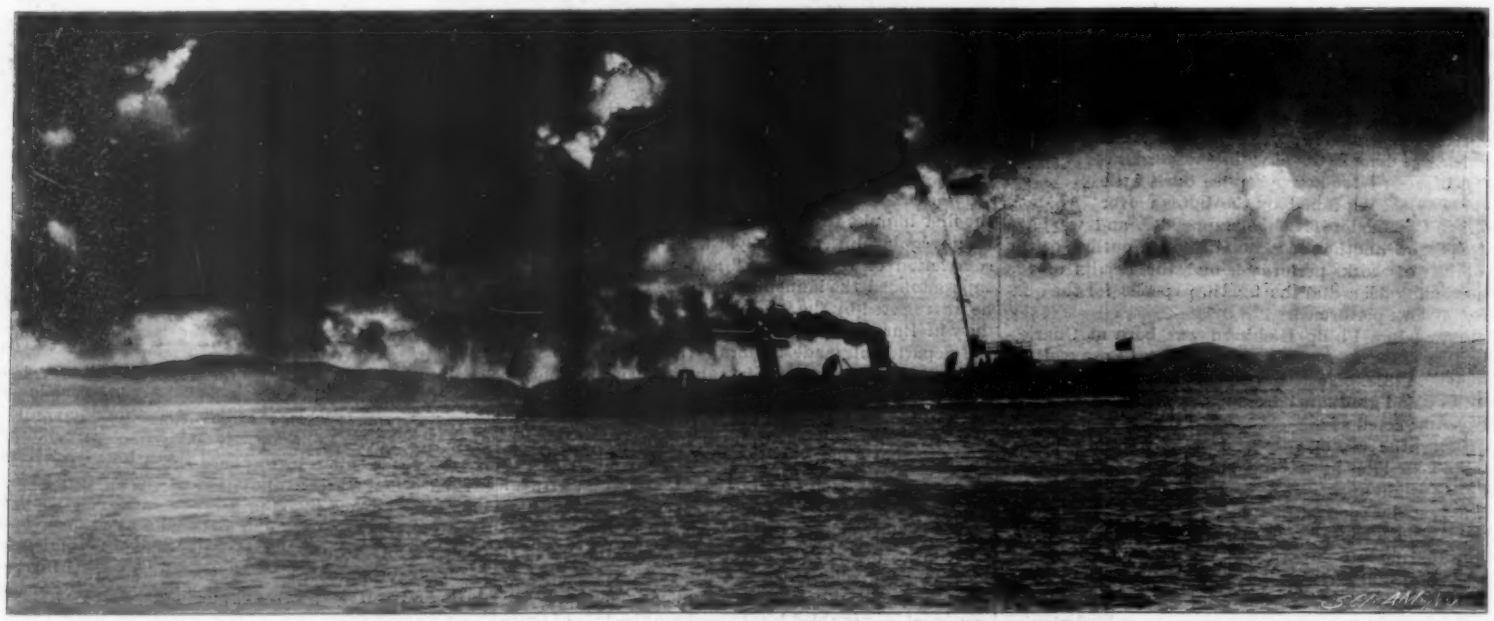
On her return, in places where the water was deep, she made over 32 knots.

The trials of the "Farragut" have been closely observed by the people of San Francisco, and the wonderful speed of the curious craft has been satisfactory to every one who loves the navy and who notes the addition of a new protective machine with great interest. Her appearance upon the bay, while tearing along at full speed, was highly interesting. She cut through the water like a razor, raising scarcely any wave and leaving only a moderate swell behind.

The "Farragut" was launched on July 16, 1898, and her cost to the government was $227,500. She is the first destroyer completed and the speediest of her class yet built. The dimensions of the new torpedo boat destroyer are: Length over all, 213 feet 6 inches; beam, 20 feet; depth, 13 feet 4 inches; and her draught is 6 feet. Ordinary displacement is 240 tons; when in commission, her displacement is 270 tons. She will carry 85 tons of coal, sufficient for 2,000 miles at a speed of 10 knots.

The engines of the "Farragut" are four cylinder triple expansion and are rated at 5,000 horse power. The cylinders are 20 and 29 inches in diameter respectively, with two compressors 30 inches each. The stroke of her engines is 18 inches and the speed of her propellers 400 revolutions. The propellers are of composition, with three blades each, and are 6 feet 9 inches in diameter, with a pitch of 8 feet 9 inches. The boilers are the Thornycroft tubular, three in number and 15 feet in length. Each has an area of 65 square feet and 4,020 square feet of heating surface, and are calculated for a pressure of 240 pounds. Amidships the sheathing is of 6-pound boiler plate, at the extremities of 4-pound.

The armament of the "Farragut" will be powerful for a vessel of her size. It will consist of four 6-pounder rapid-fire guns and two 18-inch torpedo discharge tubes. Two of the guns will be mounted on the forward platforms surrounding the conning tower and two on the main deck. Her complement of men will be forty in number. The steering of the vessel, which was perfect in all her preliminary trials, is effected by a double cylinder engine secured in the bulkhead abaft the engines. There are altogether twenty-nine steam cylinders in the vessel. A test of the time required to raise steam in the boilers resulted very satisfactorily, and the easy maintenance of high pressure, even when at the highest speeds, was demonstrated.



THE TWIN SCREW TORPEDO BOAT DESTROYER "FARRAGUT" ON HER TRIAL TRIP.

No Restraint of Trade.

An attempt on the part of J. W. Goddard & Sons, manufacturers of Feder's Brush Skirt Protector, to retard the introduction of all similar articles, by securing a monopoly of the advertising, has been defeated by the Supreme Court of New York State.

The method employed by this firm consisted of efforts to make contracts with advertising mediums, in which it was provided that these publications should refuse to admit to their columns the advertisements of competing firms, thus securing for themselves the exclusive advertising privileges for skirt protectors. Through a misunderstanding on his part, Mr. D. J. Kelley, manager of The American Queen, was induced last July to sign one of these exclusive contracts on behalf of his magazine, but as soon as he discovered the real nature of the agreement he at once refused to carry it out. The Goddards' advertisement was accordingly omitted from the September number of The American Queen, while an advertisement for a shirt protector manufactured by the Stewart, Howe & May Company appeared therein. The result was that the Goddards obtained a temporary injunction against the magazine and the Stewart, Howe & May Company. Their triumph was short lived, however, for, when the motion to make the injunction permanent was heard, Supreme Court Judge Dugro promptly denied it and dissolved the injunction.

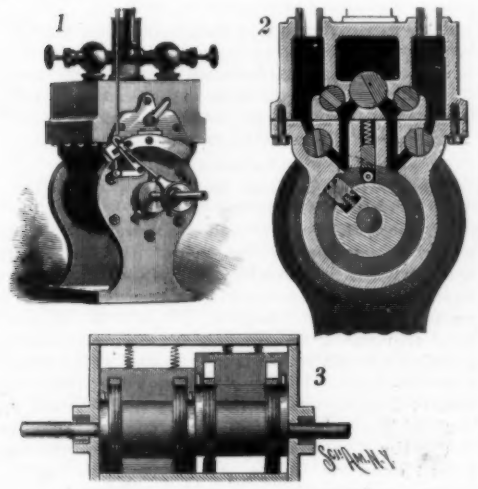
This outcome of the affair indicates conclusively that the judiciary of the United States will not sanction any procedure on the part of publishers or advertisers tending to the restraint of trade. In fact, it is possible that the matter will go yet further, and publications making such exclusive contracts be excluded from second-class mail rates.

CAR couplings have perhaps as much attention paid to them by different inventors as any other apparatus. In a late invention, the coupling is of somewhat different pattern than usual, the old link and pin being done away with, as in the improved form of couplers, and so arranged that the striking together of the couplers serves to lock them securely together, and to separate them it is only necessary to pull a lever in an upward direction and the deed is done.

AN IMPROVEMENT IN ROTARY ENGINES.

The rotary engine illustrated herewith consists principally of a cylinder, in which a revolving piston is mounted; a spring-pressed abutment fitted to slide in the cylinder; cams which move the abutment outwardly against the tension of the springs; and valves which control the inlet and exhaust ports.

Of the accompanying illustrations, Fig. 1 is a perspective view of the engine; Fig. 2 a cross section; and Fig. 3 a side elevation of the piston.



AN IMPROVED ROTARY ENGINE.

The piston is duplex in form and turns concentrically with the cylinder. The two piston-heads are arranged diametrically opposite each other, and are pressed outwardly into the working chamber by means of springs, as shown in Fig. 2. Abutments placed at the top of the cylinder and provided with friction-rollers at their inner ends slide in a radially disposed guideway. As indicated in Fig. 3, one abutment operates in conjunction with one piston and its head, while the other abutment coacts with the other piston and its head. The abutment-rollers are pressed firmly into engagement with their respective pistons by means of springs (Figs. 2 and 3). Each abutment, as its corresponding piston-head approaches, will be moved outwardly against the tension of its spring by a cam formed on the piston, and will be returned to its normal position by the spring after the head has passed. Two chambers are, hence, always formed between the corresponding abutment and piston in each working chamber. As indicated in Fig. 2, two sets of ports and cut-off valves are provided, one for each working chamber.

In a lever connected with the valves, a slide-block is carried which is connected with an eccentric on the main shaft, and which is controlled by the governor-stem (Fig. 1). When the engine is in operation, the eccentric will rock the lever and the valves, in order to cut off or admit steam, the amount of cut-off depending upon the position of the slide-block controlled by the governor-stem and lever. In this manner the engine can be automatically caused to maintain a uniform speed.

The engine has been patented by its inventor, Charles G. Taylor, of Burlingame, Kans.

Acetylene for Street Lighting.

The city of Wabash, Ind., is soon to be lighted by an acetylene gas plant, now being installed by the Logansport and Wabash Valley Gas Company, otherwise known as the Deitrich Syndicate, says The Railway Review. The machinery and materials are now on the ground and the city authorities inform us that the street lights will probably be in operation shortly. The city has heretofore been lighted by artificial gas, in the usual way, and the substitution of acetylene for street lighting is an experiment which has been but little tried.

A NEW WAGON-JACK.

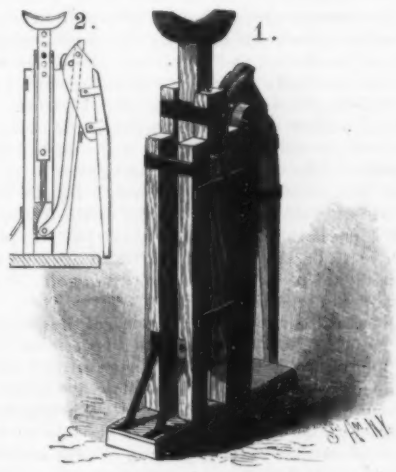
A wagon-jack has recently been patented by George W. Stoddard, of Billings, Mont., which is provided with means whereby the wheel-supporting standard can be adjusted in a lever-operated slide carried by the jack-body.

Fig. 1 of the annexed illustrations, is a perspective view of the jack, and Fig. 2 is a vertical section.

The jack-body is composed of connected side pieces, each made in two sections mounted on a base and spaced apart. One section of each side piece is provided with ears between which a lever is fulcrumed. Connected sliding bars are mounted between the sections of the side pieces. To the sliding bars a link is secured, as shown in Fig. 2, which link is so pivoted to the lever that it is virtually self-locking.

An apertured wheel-supporting standard carrying a supporting head for the wheel-hub has guided vertical movement in the space between the sliding bars and may be carried far beyond the upper ends of the sliding bars and held in adjusted position by passing a pin through a hole in the sliding bars and one of the apertures in the standard.

By moving the lever upwardly, the sliding bars are lowered. By carrying the lever downwardly, the sliding bars are raised and the wheel-supporting standard is forced up to elevate the wheel. When moved down, the lever prevents the standard from dropping or the sliding bars from moving down.



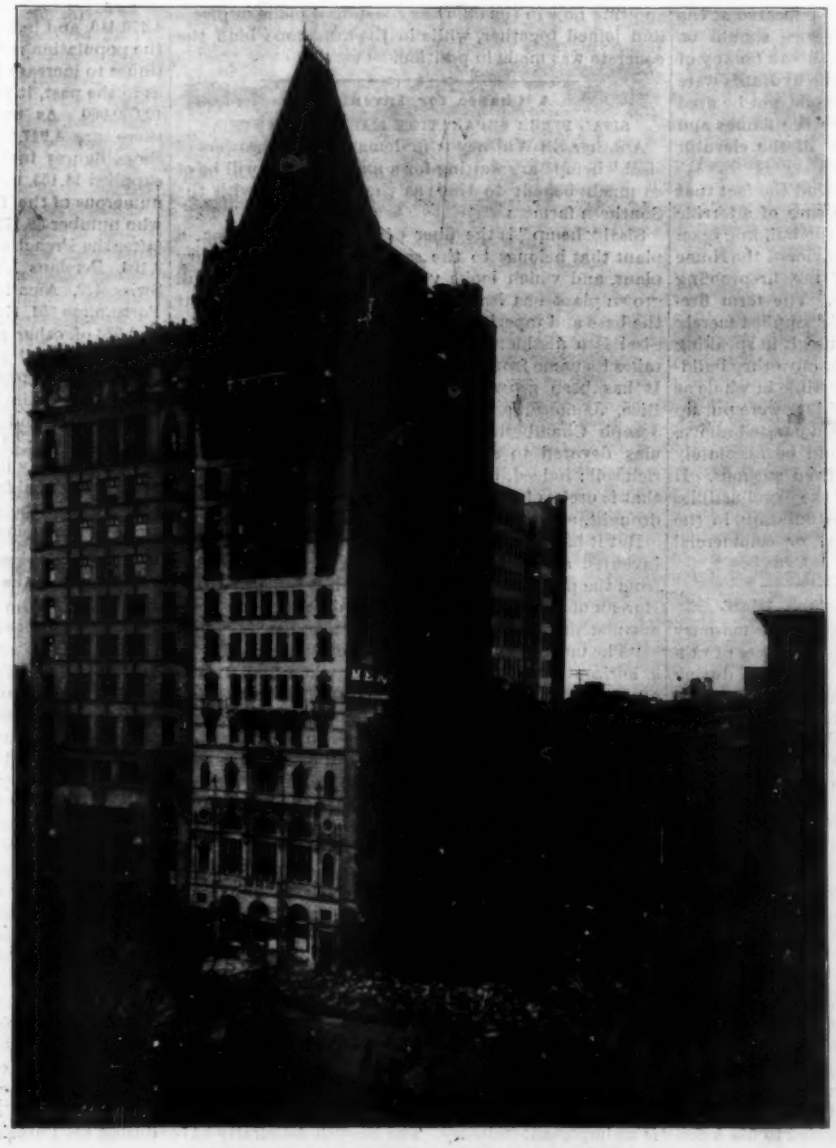
STODDARD'S WAGON-JACK.

SEVERE FIRE TEST OF THE MODERN "SKY-SCRAPER."

In the partial destruction by fire on the night of December 4 of the Home Life building, New York, the fire-resisting qualities of the tall skeleton building have been put to about as severe a test as could well be devised. Although this is by no means the first time that the skeleton-frame system of construction has been tested by fire, it is the first occasion on which a truly representative "sky-scraper" has been burnt out by a fierce fire, and the results of the trial are being noted carefully by all whose interests are in any way affected by this class of building.

By the courtesy of the New York Fire Department, we were given an early opportunity to visit the burned building, and, after a careful inspection of every floor from the eighth to the top, we must admit that it has fully demonstrated its fireproof qualities. Of course the term fireproof is an elastic one; but in this particular case the building has proved to possess all the fireproof qualities which the architects aimed to give it.

The building stands on Broadway, facing the City Hall Park. To the south of it on the same block is the Postal Telegraph building, a modern fireproof structure, while to the north of it, on the corner of the block, was a five-storied building occupied by Rogers, Peet & Company. The latter building was erected many years ago before the era of fireproof steel construction. It had the solid walls, wood floors, and cast iron columns common in earlier construction. The fire started in the basement of this building at 9:50 P. M., and spread with such rapidity that by 10:30 the roof had fallen in and the whole corner was one huge blazing furnace, the flames and heat from which were driven against the north wall of the sixteen-story Home Life building. The plan of the latter structure is in the form of the letter E, with the center of the letter removed. The open well or shaft thus formed was directly facing the fire, and up this shaft the flames of the adjacent burning building were drawn, setting fire to the woodwork of the windows, and starting fires on every floor from the eighth to the top. The heat of the fire was intensified by the fact that the heaviest gale of wind yet recorded in this vicinity was blowing from the northeast, the wind reaching a velocity of eighty miles an hour shortly before the fire started. Blowing from the northeast, the wind would come from the point of view at which our photograph was taken, and with this fact in mind the reader can understand to what a searching test the vast northern face of the Home Life building was subjected.



HOME LIFE BUILDING AFTER THE FIRE.

Not one of the windows on this side was protected by iron shutters, and the entrance of the fire through the windows on the several floors was only a question of time. The exposed upper portion of the building withstood the fire for about half an hour, but at 10:25 the flames ignited the woodwork of the windows, cracked the glass, and set fire to the office furniture. The firemen were able to do very little in the north and east of the building, the fierce gale driving the flames in upon them, and from the time the fire first gained a foothold until the combustible contents of the various floors had been burned out, the conflagration burnt with very little beyond the fireproof construction of the building to obstruct it.

The fireproofing was of the standard type and was fairly well representative of the best modern practice. The frame consisted of steel columns and girders incased in hollow, terra-cotta fireproofing, and the floors consisted of steel I-beams filled in with hollow, fireproof bricks, which overlapped and protected the bottom flanges of the I-beams. The sleepers upon which the wooden floor was laid were so placed that in case of a fire it would be impossible for any draughts of air to circulate

across and beneath the wooden floors and assist them in taking fire. In buildings of a later date this has been improved upon by filling in the voids between the brick arches and the wood floor with ash concrete.

The combustible material consisted of the floors, the doors, the windows, and such office furniture, books, etc., as the various rooms contained. This was completely burnt away without, as far as can be judged, seriously affecting the shell of the building. In no case have the main columns of the building moved out of plumb, nor is there any evidence of the girders or I-beams of the floor systems having deflected. In only one case, as far as we could find, had the brick arching of the floors given way, and in this case the collapse was due to an unusually heavy safe, which seems to have been standing exactly between two I-beams. The hollow fire-brick partitioning between the rooms has fallen down in some cases, but in many of the rooms it is intact. The most serious damage has been done to the outside walls. The Broadway façade, which was built of marble, has been badly calcined from the eighth story to the top, and this upper half will probably have to be rebuilt. The northern brick wall has been badly disintegrated by the fire and will also need repairs, if not replacing.

The fire has demonstrated the truth of the prediction made by Chief Bonner of the Fire Department that if the upper half of a tall building such as this caught fire, the firemen could do very little to save it from being burnt out. It is his opinion that the height should be limited to 150 feet, since it is impossible to bring effective streams of water to play upon a fire above this level.

While the burning of the Home Life building teaches us no new lessons, it strongly emphasizes several facts which were well known but little heeded before the fire:

1. That all the windows of such a structure that are above and overlook the roof of an adjoining building should be provided with either metal or metal-cased shutters. The presence of these would undoubtedly have kept the fire out of the Home Life building.

2. That, to render each floor fireproof, the window sashes and frames, the doors and door frames, the floor and all kinds of finish that is now in wood should be of metal, or of wood metal-cased.

3. The elevators and the stairways at each floor should be provided with sliding or folding trapdoors by which all communication could be shut off between the various floors, and a fire confined to the floor on which it started.

4. A tank of liberal capacity should be located at the top of all lofty buildings, and the service should be such as could readily cope with an outbreak on any of the floors. In the present instance, the hydrants were not far from the elevators, and they could not be used because of the terrific gale that drove the flames and heat in through the broken windows of the elevator shaft.

Taken altogether, and bearing in mind the fact that the absence of shutters and the pressure of a terrific gale of wind laid the whole side of the building open to the fiercest kind of attack, the behavior of the Home Life building is an indorsement of the fireproofing methods adopted by our architects. The term fireproof, as we have said, is relative. As applied merely to the shell of the building, we may use it in speaking of this building. But neither this nor any other building in this city is absolutely incombustible in whole as well as in part. If, however, a building were put up which embodied the four features enumerated above, as none of them do at present, it would be absolutely unburnable either from within or from without. If such a structure were burnt out, the combustibles would have to be brought into the building in the shape of the furniture, books, papers, or commercial wares of the tenants.

Concrete Facing on a Sandstone Bluff.

The use of concrete as a substitute for stone masonry has been conspicuous in several notable pieces of railway engineering now in progress or completed during the past season. The Railway Age recently illustrated an interesting use of concrete for facing a sandstone bluff at St. Paul. The line of the Chicago, Milwaukee & St. Paul Railway, at St. Paul, extends over an ascending grade along the face of the bluff. This bluff is of a character common to the Mississippi River bluffs in that vicinity, and is composed of soft sandstone capped with an irregularly broken ledge of friable sandstone above, mixed with loose sand, gravel, and bowlders. This sandstone disintegrates readily, and is so soft that it wears away rapidly under the influence of the weather. The detritus from the bluff has frequently to be removed or it would cover the railway tracks. The wearing away of sandstone undercuts the limestone ledge, threatening the safety of the trains on the track below. It has been found necessary to build masonry walls on the face of this bluff for the protection of the railway tracks.

In the summer of 1897 it was decided to protect an additional stretch of the bluff, and the Engineer of Bridges and Buildings, Mr. Bates, decided to use a concrete facing instead of cut stone masonry. He assumed that the stability of sandstone would be secured if it was protected from the rain or frost, and that a facing of concrete or brickwork would furnish protection equal to that of cut stone masonry, at a great saving of cost. The material was removed from the face of the bluff and brick pilasters were built under the angular outcrop of the limestone bluff. The pilasters varied from 6×12 feet wide and between 4 and 5 feet thick. The foundation for the pilasters and concrete facing is in the sandstone, 4 feet below the base of the rails. Supporting frames for the concrete between the pilasters were built as follows: Bolts were let into the sandstone at a distance of 8 feet apart horizontally and vertically. With special augers holes were bored in the sandstone of from 4 to 5 feet deep, inclining downward, so that the bolts were perpendicular to the face. The holes around the bolts were filled with mortar and they were allowed to project 18 inches beyond the face of the sandstone. They served to hold the plank uprights in place.

The uprights consist of two planks with the bolt passing between them. The planking supported the concrete work, which was placed against the inner edges of the uprights. This framework was built in horizontal sections, the uprights and planking used at the bottom being afterward used again higher up on the wall. To remove the planking it was only necessary to unscrew the nuts which held the uprights. The bolts which were necessary to secure the concrete frames were allowed to remain in the sandstone, and the value they gave in holding the concrete in place was gained without extra cost. It should be said that the great bolts had a second extension section secured to them with the aid of a nut. This section was, of course, removed, as it only held the planks. The concrete facing was continued from the top of the limestone ledge to the top of the bluff, and special care was taken to make the work tight to the top, so that water would not get in behind the concrete. No attempt was made to put in the concrete with uniform slope and it was allowed to follow the formation of the bluff. The total cost of the wall, which was 256 feet 6 inches long, was $6,787.36. The work was expensive, on account of the limited space for working between the railway and the bluff and the necessarily expensive nature of the concrete frames, but the cost per yard was less than if cut stone masonry had been used. The work has been in place for a year and no faults appear in it. The dam shown in this issue of the SCIENTIFIC AMERICAN is also built of concrete, and a comparison is useful, as showing how in the dam the concrete is made in pieces and joined together, while in the sandstone bluff the concrete was made in position.

A Chance for Inventors.

SISAL FIBER SEPARATION MACHINE WANTED.

Another Eli Whitney is in demand. The growers of sisal "hemp" are waiting for a machine that will be of as much benefit to them as the cotton gin with the Southern farmers.

Sisal "hemp" is the fiber of the Agave sisalona, a plant that belongs to the same family as the century plant, and which looks very much like it. The full grown plant has leaves from 4 to 6 feet long, thick at the base and tapering toward the spine-tipped points. Sisal is a distinct production of Yucatan; in fact, it takes its name from one of the cities of the peninsula. It has been grown with some success in Cuba, Porto Rico, Jamaica, and Southern Florida. The Hon. Joseph Chamberlain has a plantation on the Bahamas devoted to sisal. The plant does not need a rich soil; indeed, it grows best on barren, rocky land that is useless for other purposes. It is not affected by drought, except almost inappreciably.

But it has one drawback. There has not yet been invented a perfect machine for separating the fiber from the pulp of the leaves. The last bulletin of the Bureau of the American Republics describes the present machine, its work, and its imperfections:

"The machine in use at the present time consists of a horizontal wheel, on the face of which brass strips are transversely placed, forming dull knives. The leaf is introduced so as to bring one side in contact with the revolving wheel, which is run by a small engine. A brake then presses the leaf against the scrapers, while the butt is firmly held by a pair of pincers. The scrapers remove the outer surface and some of the soft tissues; then the leaf is taken out and turned and the other side undergoes the same operation, until only the fibers are left. These are then shaken out and hung in the sun for a few hours to dry. The result is a rather coarse fiber of much strength. The finest quality is nearly white, while the inferior grades are yellowish in color. In order to produce the best quality in fiber the leaves must be cleaned as soon as possible after being cut. One of the principal obstacles in the way of cheaper fiber is the need of a good machine for decorticating. Although much skill and money have been spent in attempts to invent a better machine, as yet such efforts have been unsuccessful."

The growing of sisal and the separation of the fiber is an important industry. The English Admiralty have adopted the sisal in preference to the hemp cable. The United States, in the fiscal year ended June 30, 1898, imported from Mexico over $5,000,000 worth of sisal, against $3,000,000 worth of hemp from the Philippines.

The French chargé d'affaires in Mexico has recently addressed a report to his government relative to the growing importance of the sisal fiber, which he states is very difficult for European houses to secure, as the United States practically monopolizes the trade in this article.

There is here certainly a chance for some American inventor to step into the breech and distinguish himself. Americans have invented pretty nearly everything they have attempted to, and it seems a pity that they cannot improve on a little brass-shod wheel in Yucatan.—The Hartford Courant.

Explorations Among the Ruined Cities in Montezuma Valley.

Mr. George H. Pepper, of the Department of Anthropology of the American Museum of Natural History, recently returned after a five months' tour of the Southwest, bringing a large quantity of specimens which he gathered during the summer. This is Mr. Pepper's third trip among the wonders of this comparatively little known country. A large quantity of photographs were also taken. He was accompanied by two young men of Boston, who went for purposes of study, and Richard Wetherill, one of the cowboys who were famous as the discoverers of nearly all of the marvelous ruined cities left by the mysterious cliff dwellers of Colorado. Days were spent in the famous cliff palaces near the Montezuma Valley. Here they found skeletons, stone utensils, and half a dozen bells of soft copper which are the only metal objects which have been discovered in these ancient settlements. They were preserved by the dryness of the air in the great cavern city. The party rode 400 miles on bronchos to see the snake dance of the Moqui Indians, which lasted twenty-seven minutes, and they secured some excellent photographs of the filthy, painted savages dancing around with live rattlesnakes hanging from their jaws. After the dance, the snakes are set at liberty. The performance is really a public prayer for rain.

The Population of Egypt.

"During the last hundred years the population of Egypt has shown a constant increase," says The Journal of the Society of Arts. "In 1800 it consisted of 2,460,200 souls, in 1846 this number had increased to 4,476,440, and in 1882 to 6,813,919. At the present time the population is estimated at 9,734,405, and if it continues to increase in the future in the same proportion as in the past, it will amount by the year 1912 to about 12,000,000. As regards the distribution of the sexes, there are 4,947,850 males and 4,786,555 females, and these figures include 112,526 foreigners. France has supplied 14,155, the United Kingdom 19,557. The most numerous of the foreign inhabitants are the Greeks, who number 38,172, then come the Italians 24,467, and (after the French and English) Austrians 7,117, Russians 3,193, Persians 1,301, Germans 1,277, Spaniards 765, Swiss 472, Americans 291, Belgians 256, Dutch 247, Portuguese 151, Swedes and Norwegians 107, Danes 72, and 923 of other nationalities. In lower Egypt there are 5,676,109 inhabitants and in upper Egypt 4,058,296. Public instruction leaves much to be desired, for of the entire population only 467,886 persons are able to read and write; there are, therefore, 9,266,819 inhabitants, or 95 per cent of the aggregate population, completely illiterate. What is even more extraordinary is the fact that 6,486,498 persons, or about two-thirds of the entire population, are without any trade or profession."

The Acanthus Column at Delphi.

M. Homolle, in the issue of the Bulletin de Corr. Hellénique, gives a detailed analysis and discussion of the remarkable acanthus column surmounted by dancing caryatids. The column, it will be remembered, was published in the Gazette des Beaux Arts, 1895, but since that publication many fragments have been added, and the monument is now certainly one of the most curious and interesting architectural discoveries made of recent years. M. Homolle thinks the style cannot be earlier than the second half of the fifth century B. C.; certain archaic peculiarities in the treatment of hair, eyelids, and chin in the faces of the dancers prevent its being dated any later. The question remains of its explanation and the motive of its dedication. It seems to have stood on the terrace of the temple of Apollo. The figures of the dancers in their short chitons are thoroughly Dorian, and suggest Sparta. They must be of the type of the Lacænae saltantes. The acanthus plant, by the sort of heraldic pun so popular among the Greeks, suggests the Thracian city of Acanthus, and M. Homolle is probably right in seeing in this curious and beautiful column an ex-voto in memory of the alliance concluded between the Spartan general Brasidas and the town of Acanthus during his Thracian campaign.

Correspondence.

Wind Pressure.

To the Editor of the SCIENTIFIC AMERICAN:

A recent number of the SCIENTIFIC AMERICAN, in an editorial on Sir T. W. Barry's remarks, at the meeting of the British Association at Bristol, anent the want of agreement between the results and conclusions of experiments on a small scale and the working of nature on a more extended basis, alludes to the fact, among others, that as far as wind pressures are concerned, while at the great Forth Bridge in Scotland 58 pounds to the square foot were allowed for, based on the indications of ordinary anemometers, the result of an experiment on a 300 foot surface under like conditions showed a falling off of very nearly 40 per cent. Again, at the Tower Bridge, London, while conclusions based on anemometrical readings indicated a pressure of 6 to 9 pounds per square foot, experiments conducted on the bascules of the bridge, whose area is 5,000 feet, showed only from 1 to 1½ pounds wind pressure under absolutely similar conditions.

These glaring differences are accounted for on the assumption that a gale of wind presents areas of maximum pressure which are far in excess of the average pressure. Now, I am in a position to say that this mere surmise of the editor of the SCIENTIFIC AMERICAN is a matter of fact; and to proof: While in a gale, at Quebec, the mere galvanized iron roof sheeting of four of the octagonal kiosks on Dufferin Terrace remained untorn, which it had been on other occasions of severe gales, the fifth kiosk, situated in the midst of the other four, not only had its sheeting curled up and twisted and torn off, but the entire roof framing, all of cast iron and bolted together, was bodily wrenched from its eight supporting columns, the confining bolts of each of which were broken off, and the whole roof, some 2½ tons in weight, carried up a height of say 40 feet and over a distance of some 300 feet and deposited in a broken and demoralized condition on the glacis in rear of the terrace.

Now it is evident that in this case there was, within the general stream of easterly wind blowing up the St. Lawrence and striking the terrace, an intensified current which struck the demolished structure—a stream within a stream, so to say, as with the Gulf Stream in the ocean. I reduced the thing to figures at the time (some ten years ago or less), and found that while the anemometer at the Quebec observatory, on the occasion, indicated only 59 pounds, the stress on the roof of the kiosk, thus to tear it away and hurl it to such a distance, must have had a cyclonic force of not less than 100 to 120 pounds to the square foot.

The same thing occurred in the United States a few years ago, when, as I then showed in a letter on the subject, published in The Engineering Record, of New York, while the general go of the wind storm was insufficient to do the mischief, there must have been within the moving river of air, the rush of air in motion, a more intensified stream, which struck and overthrew two of the 500 foot spans of the Jeffersonville Bridge, each of which weighed not less than 1,000 tons.

But this does not explain nor in any way account for the difference, hereinabove alluded to, of the effect of wind currents on areas of varied extent. I think, Mr. Editor, I can account for this. It will be remembered that I was the first at the time, or for some months after the attention of the world at large had been called to the apparent paradox, to explain the so-called ball nozzle mystery, which I did by showing that the issuing circumferential jet of water carried with it by friction the water in the rear of the ball, thus creating a vacuum against which the pressure of the atmosphere reacted to keep the ball in place.

Now precisely the same thing happens with the anemometer, and the more so the larger its surface or extent. The wind, passing around its periphery, sucks out the air from in rear of it, creating a vacuum against which the atmospheric pressure on the opposite side reacts.

It will be noticed that, while in the case of the Forth Bridge, as set forth, the larger area of experimentation, 300 feet, gave a wind pressure of only 40 per cent less than that indicated by the ordinary anemometer, in the case of the Tower Bridge, the 5,000 feet area of the bascule experimented on reduced the anemometrical pressure of from 6 to 9 pounds down to from 1 to 1½ pounds, or not only by 40 per cent, but by 600 per cent, this difference being due to the proportional circumferential or linear peripheries of the surfaces experimented on, in comparison with the areas at play, the peripheries varying only as the linear dimensions, while the areas varied as the squares of those dimensions.

For instance, if the anemometer were a foot square, its area would be but 1 foot, while its periphery was 4 feet; or the area to the circumferential dimensions in the proportion of ¼ to 1. With a surface of 10×10 feet, the area would be 100 feet and the periphery 40, or area to circumference as 2½ to 1. Again, if the surface played on by the wind were 100×100 feet, the area would be 10,000 square feet, while the periphery was only 400 feet, or the ratio of area to circumference that of 25 to 1, leaving the wind to act on or around edges of 4, 40, and 100 feet respectively, while the atmospheric pressure was exercised against areas of 1, 100, and 10,000 square feet, and thus explanatory of the fact that the greater the area acted on, the greater the reduced percentage of pressure indicated by the larger surface.

CHARLES BOELLARGE, Consulting Engineer.
Quebec, October 7, 1898.

The German Toy-Industry—Its History and Development.

Although the little Thüringian town of Sonneberg, the center of the modern toy-industry, says Uhland's Wochenschrift, is commonly considered as the birthplace of toy-making, it cannot be denied that the first attempts in the art were made by the village of Judenbach, situated further to the northeast. By reason of its favorable situation near the Nürnberg-Sächsische Geleitsstrasse, a road much frequented ever since the thirteenth century, and the only means of communicating with Leipsic and Nuremberg, the village could always readily dispose of its crude wooden, house and kitchen utensils, and later, of its little chairs, tables, animals, cross-bows, swords, guns, and musical instruments.

Even long after the art of making wooden ware had been introduced in Sonneberg, Nuremberg was still the market for these peasant-products and continued to make the most by the transaction. Not without reason did the city call Sonneberg its Goldtöchterlein (little gold-daughter). Not until the Thirty Years' War had destroyed all the regular trade-communications, did the Sonneberg tradesmen themselves begin to travel about with their wares. The inhabitants of Judenbach, on the other hand, could never conclude to leave their native village in order to sell their products. While in Judenbach the toy-industry did not attain great proportions, in Sonneberg, the trade, as early as the seventeenth century, had grown to such an extent that, when public markets were established in Frankfort-on-the-Main, the merchants of Sonneberg were granted equal exemption from taxes and duties with the merchants of Nuremberg.

Till the eighteenth century, toys were colored with poisonous bismuth paints. An important step in the development of the industry was the endeavor to make those parts which were with difficulty carved of some doughy substance (rye flour mixed with lime water). But this substance softened and mildewed when moistened. A decided advance can therefore be recorded only when Friedrich Müller, a citizen of Sonneberg, began to use papier maché, a substance of which he had heard from a French soldier. The figures were no longer modeled as before, but the plastic mass was now pressed into shape by moulds. By means of this new substance Sonneberg produced its wares with almost mechanical rapidity. Toys were no longer made in the houses of peasants, but in factories. The cost of these new wares was, moreover, considerably reduced—a most significant factor in the manufacture of toys.

Strange to say, in the making of dolls but little progress was made. Not until a new method was introduced into Sonneberg, which came from China, by way of England, can any great improvement be recorded. From the first Chinese dolls of 1852, with their movable limbs strung together by cords drawn through the joints, developed the so-called "jointed dolls." In coloring the faces of these dolls, white lead, a poisonous paint, was long employed, until, by legislative action, its use was prohibited. Nowadays the innocuous zinc oxide and similar harmless colors are used. The hair of dolls, after many failures with other material, is now made of mohair and the fur of Angora goats.

In this manner the toy-industry slowly developed to its present state. How numerous are the varieties of toys now made may be inferred when it is considered that the design room of a Sonneberg factory contains from twelve to eighteen thousand designs.

In order to maintain the position which they have reached, toy-makers are compelled constantly to bring forth new models and to adapt their products to the tastes and peculiarities of foreign purchasers. Years ago, the chairman of the Sonneberg Chamber of Commerce and Industry proposed the collection of toys made by foreign manufacturers, in order that Sonneberg toy-makers might thus be able to acquaint themselves with the wants and peculiarities of foreign markets. Such a collection of models has now been made and does good service for the manufacturers, as well as for the students at the various industrial schools of Thüringia.

The toys at present made may be divided into the following groups: 1. Wares made entirely of wood, such as cross-bows, guns, violins, flutes, chess and draught boards, rattles, jumping manikins, nut-crackers, soldiers, ninepins, rocking horses. 2. Articles made mostly of wood, such as doll-houses, kitchens, shops, furniture, Punch-and-Judy shows. 3. Mechanical toys. 4. Papier maché articles, such as harlequins, riders, caricatures of national types, animals covered with felt or leather, shepherds' houses, menageries, figures of Santa Claus. 5. Animals covered with fur. 6. Metal toys, such as tin figures, toy trumpets, weapons, and theaters. 7. Figures and toys made of china, burnt clay, stone, and glass. Among these toys may be mentioned toy dishes, marbles, and articles of various kinds made of blown glass. 8. Christmas tree decorations of glass, metal, and wax. In Lauscha wax is the material most used. 9. Dolls with appurtenant wagons, chairs, and swings.

Besides Sonneberg, the towns and villages of Watterhausen, Friedrichsroda, Ohrdruf, Ilmenau, Hildburghausen, Schleusingen, and Coburg are engaged in the industry. Toy-factories are now scattered more or less over half of Germany; they are distributed from the Black Forest and the Palatinate to the Sudetic Mountains and the province of Brandenburg. Of particular importance are the Erzgebirge of Saxony, which, on account of their forests and abundant water-power, have enabled the manufacturers of Saxony to produce many of the more common toys formerly made in Sonneberg.

The most recent statistics show that Germany has exported 40,500,000 marks' ($10,125,000) worth of toys, while in 1895 but 30,000,000 marks' ($7,500,000) worth were sent abroad. Including the toys sold in Germany, the product of the entire German industry is probably worth 50,000,000 marks ($12,500,000), from which 750,000 marks ($187,500), representing the value of toys imported from foreign countries, must be deducted. Sonneberg undeniably produces half the toys made in Germany. The two largest buyers of German toys are the United States and England. Last year, the United States imported German toys to the value of 11,000,000 marks ($2,750,000), England to the value of 17,000,000 marks ($3,750,000). Of the products exported to the United States, 6,500,000 marks' ($1,625,000) worth were supplied by Sonneberg. A similar proportion holds good for England. To the development of toy-manufacture and to the rise of doll-making is due the increase in the number of export houses in Sonneberg. In the sixties there were about thirty export firms. By 1880 the number had increased to forty-eight and by 1896 to seventy. According to the latest statistics, there are 40,829 persons engaged in German toy-manufactories, of which number 44 per cent are employed in Sachsen-Meinigen. In the region about Sonneberg about 34 per cent of the population are engaged in toy-making, not including those who, in addition, are otherwise employed.

Luminous Sugar.

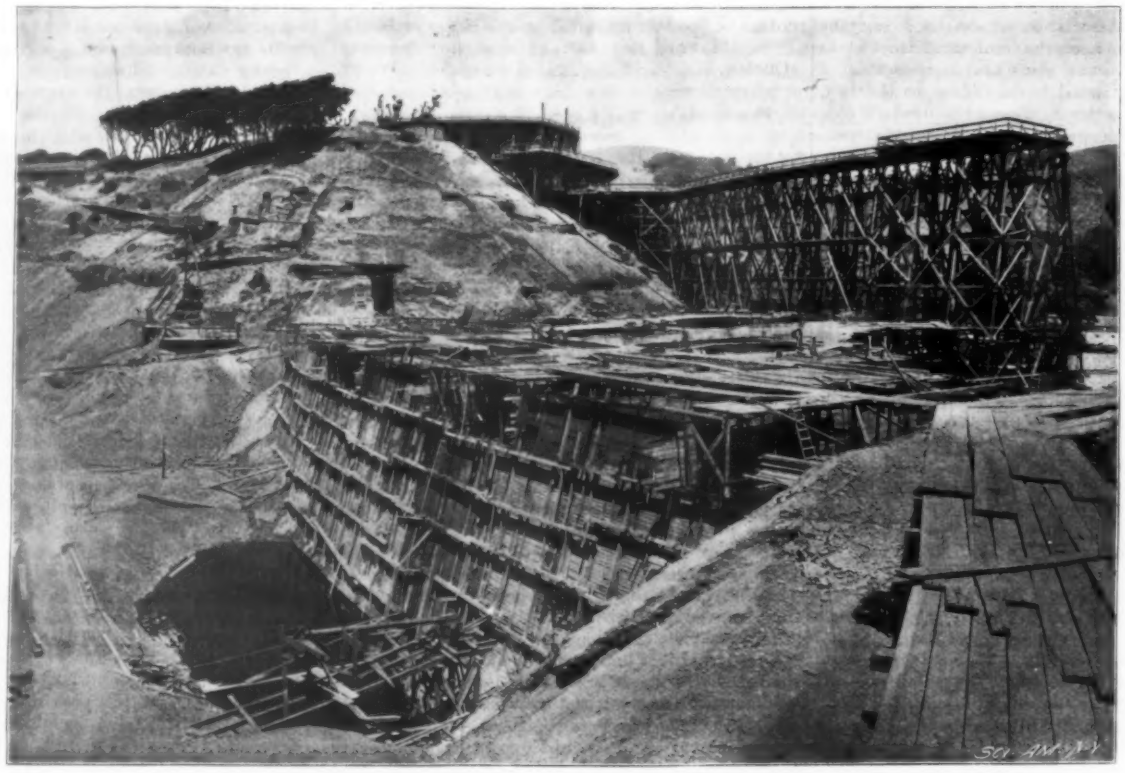
There are phenomena attending the formation of crystals which are apparently quite distinct from chemical action, says The Lancet. When, for example, a hot saturated solution of arsenious acid is allowed to cool, the act of crystallization is accompanied by a flash of light. As each crystal forms there is a short, sharp glow, indicating the release of a certain amount of latent energy in the form of light radiation. A related phenomenon would seem to be the case when two pieces of cane sugar are quickly rubbed together. The flash is perfectly distinct and bluish-white in color, the light extending into the substance itself far below the surface. Some interesting experiments on this manifestation have recently been made by Mr. John Burke, M.A., the results of which were communicated to the recent meeting of the British Association of Science at Bristol. By mounting disks of loaf sugar on a lathe and projecting a hammer on the rotating surface an almost continuous luminosity was obtained. The wearing away of the sugar is compensated for by arranging a gradual approach of the piece to the hammer in exact accordance with the amount of sugar scraped away. In this way the spectrum has been observed and photographed. From these observations it would appear that the luminosity cannot be due to the particles of sugar becoming red hot or white hot by the impacts, the indication being that the light produced is due either to some change in the configuration of the crystals of sugar or to some sort of chemical action set up between the sugar and the surrounding air at the freshly formed surface. The fact, however, that the surrounding medium does not seem to affect either the color or intensity of the luminosity suggests that the effect is not due to any influence of a chemical nature of the surrounding medium on the sugar, but favors the former hypothesis that the luminosity is due to some structural disturbance in the sugar itself. This ingenious and pretty study is being pursued further and the result should lead to some interesting observations. Light is so often a manifestation of physical change that it is probable some day we shall derive it for illuminating purposes in a totally different, much simpler, and less clumsy way than obtains at present.

A. GAUTIER finds that free hydrogen is a constant constituent of the atmosphere: it is only present in very minute quantities, from 11 to 18 c. c. in 100 liters of air, or on an average about 0·015 per cent by volume. Its volume is, therefore, nearly one-half that of the normal amount of carbonic anhydride present in pure air.—Comptes Rendus, cxxvii., 694.

A GREAT CALIFORNIA DAM.

The largest concrete structure in the world, and the highest dam in the United States as well, is located five miles west of San Mateo, Cal., a suburb of San Francisco, from which it is distant about twenty miles.

The Crystal Springs dam is celebrated among engineers for its magnitude as well as for the original methods and principles which are involved in its construction. It was determined to avoid the difficulties met with in dams of even much smaller dimensions, constructed on the monolith plan, from the shrinkage and cracking of the concrete; and the engineer of the company, Mr. Herman Schussler, devised a dam of large dimensions composed of individual blocks, building each block separately, so as to give the blocks an opportunity to set and harden by themselves.



6.—General View of the Sweetwater Dam During Construction.

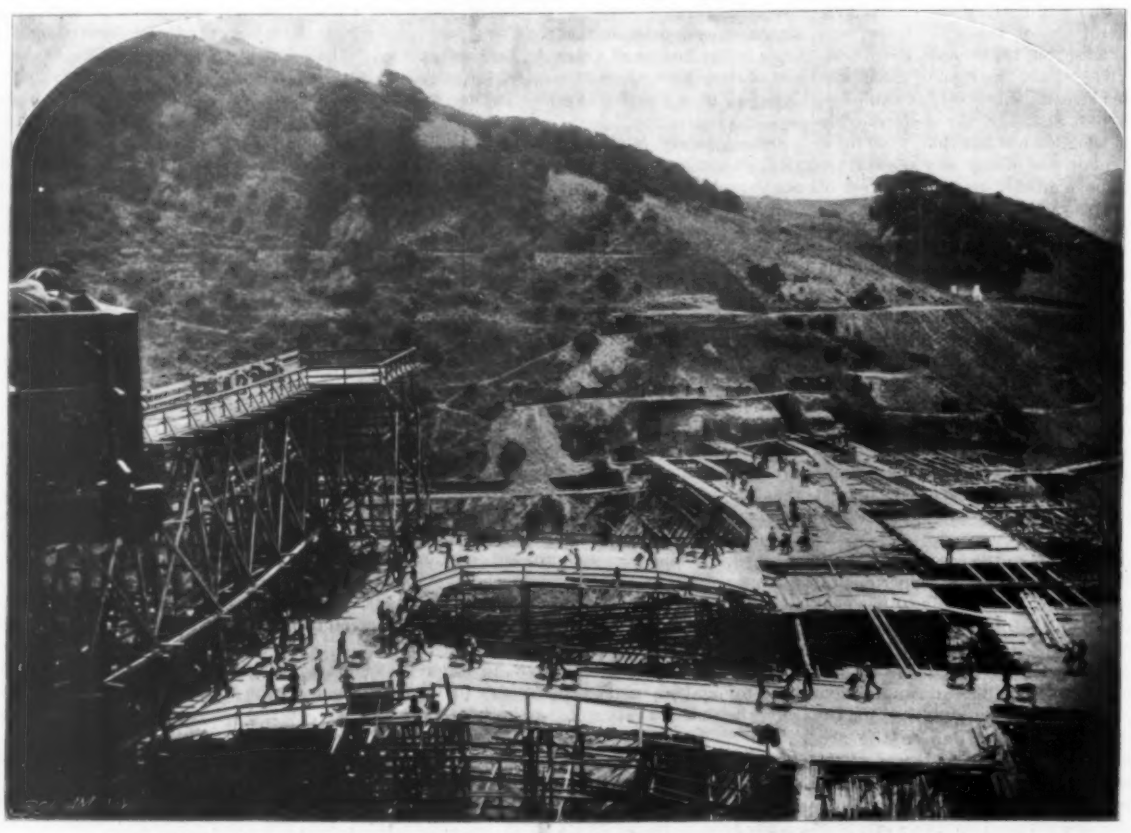
The site for a great artificial reservoir at this point could not have been surpassed. The lower terraces of the range of mountains which start from the Golden Gate and traverse San Mateo County from north to south here approach the lower bay of San Francisco, and at the dam site the rocky walls of the cañon, rising to a height of over 200 feet above the bed of the creek, meet within 700 feet, inclosing a valley of large dimensions that spreads out in either direction for long distances, and with the dam at its present height, 145 feet, forms an artificial lake nearly nine miles in length. The task, therefore, of this great structure is to restrain an enormous body of water, and to withstand, perpetually, a pressure of 130,000 tons against its face at its present height.

The present height of the dam is 145 feet. At the base it is 176 feet thick. On the summit it is about 700 feet long and 40 feet thick. The plans contemplate an addition of 30 feet to its present height, making a total of 175 feet in extreme height, with a total length of about 880 feet. The lake thus occasioned will contain 29,000 million gallons of water.

Fortunately, the geological formation of the locality was favorable to securing a reliable foundation. The rock is hard blue sandstone, extremely dense and compact, and entirely free from cracks or fissures. The site for the dam was scientifically exploited, and hundreds of borings, some to a depth of 100 feet, were driven into the rocky sides of the cañon. All required conditions were found at the site selected. Preparatory to laying the foundation the whole bottom and sides of the cañon were cleared of all soil and vegetation until the bed rock was uncovered. The entire foundation was then hewn out to a depth of from 8 to 35 feet. No explosives whatever were employed in this work, in order that the bed rock might not be either broken or cracked. All the softer portions of the rock were cut out, leaving the hard rock undisturbed, thus allowing the superstructure to dovetail itself into the rock base. In order to insure that the foundation should be absolutely watertight, a trench 17 feet deep, 10 feet across at the top, and 5 feet wide at the bottom, following the center line of the dam from end to end, was hewed out of the rock base down to the absolutely watertight ledge below. The excavation will be noticed in the hillside at each end of the dam, in illustrations 6 and 7. This trench was then filled with concrete and heavily rammed.

The bed rock foundation having been thus carefully prepared, the laying of the concrete blocks to form the superstructure began. The bed rock was first cleaned from all debris and dirt and thoroughly hosed. These blocks (see Plate 1) averaged 40 feet in length, 30 feet in width, and 8 feet in thickness, and each was a day's work in itself. Two such blocks were built daily. Separate blocks were built first over the surface of the dam, each having niches and projections on the tops and sides. The first set of blocks may be likened to the black squares set in a chessboard. After the dam had been covered by these blocks and they had set and hardened, the spaces between them, which represent the white squares on the chessboard, were filled in by the second series of blocks. The niches and projections in the blocks of the first tier fitted closely into the secondary blocks (see Fig. 2), breaking joints with them so perfectly that not only were the blocks tied together in a most substantial manner, but watertight broken joints were made between the two series of blocks. The primary tier of the next stratum of blocks was then commenced, these primary blocks being so placed that their centers came approximately over the junction of four of the former blocks. In this manner construction of the dam continued until finished to its present height. In all, 500 of these blocks were used.

For their construction, a framework of varying dimensions and irregular in outline, according to the shape of the block required, was built up at its proper place on the dam. Concrete was gradually dumped into this mould until at last it was filled. As fast as it was thrown in it was carefully spread out and rammed down with heavy iron rammers into a compact mass. The block was allowed to remain in the framework for several days, or until the moisture had evaporated, by which time it had become as hard as the rock upon which it stood. This method was followed with each block. No two blocks were identical in shape or size, each interlocking with its neighbors and contributing combined support to all of the others. The device of building this dam with a large number of separate blocks, instead of as one great mass of concrete, is the distinguishing feature of its construction, and provides the elasticity which secures it from damage in the event of shrinkage.

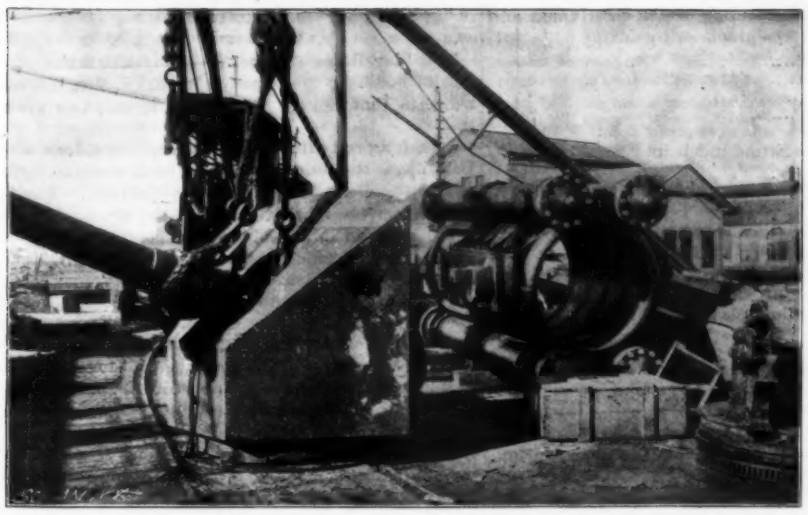


7.—Staging and Platforms Used in Preparing and Mixing the Concrete and Wheeling it to the Dam.

CONSTRUCTION OF THE CRYSTAL SPRINGS DAM, CALIFORNIA.

The sand used in mixing with the concrete was procured at North Beach, San Francisco. Rock of the required density and strength was procured in unlimited quantities, only a mile away from the dam, from a quarry owned by the company. Mechanical devices for making the concrete and transporting it around the dam were employed whenever it was possible.

A great framework consisting of three platforms was



1.—A 5½-INCH GUN FROM THE "OQUENDO."

Shield penetrated by shell at Santiago. Saddle of 13-inch gun for the "Kearsarge" seen to the right.

first erected (see Figs. 6 and 7.) On the first platform the great rock-breaker was placed, which reduced the rock to about the size of a walnut. On the platform below was stored the sand and cement. The broken rock, after being washed, was dumped through a chute into a large iron drum holding six barrels or about twenty-two cubic feet. A car holding two barrels of sand and one barrel of cement was brought forward, and in this proportion the whole was dumped through a chute into a mixer placed on the platform below, water for the concrete being fed in proper quantities through a nozzle in the axle of the mixer.

Power for operations was supplied by three detached engines situated on the lowest platform. After the sand, rock, and cement were thoroughly mixed, the material was dropped into cars running upon a trestle and carried over the dam where the last block was being formed, each car load being dumped through a large pipe to a platform, and thence by wheelbarrow (see Plate 7) into the frame on the dam site where the block was to be stationed. This plan was followed successively until the dam was completed. The capacity of the concrete machines was 450 barrels, or about 10,000 cubic feet, daily. The amount of material consumed gives some indication of the great size of the work. It included 205,000 barrels of the best Portland cement, 410,000 barrels of sand, and 1,230,000 barrels of rock.

The front slope of the dam is 1 foot horizontal to 4 feet vertical; the rear slope commences 1 foot vertical to 1 foot horizontal, ending in the upper 60 feet with a slope 2 feet vertical to 1 foot horizontal, the two rear slopes being connected by a curve of about 300 feet radius. The convex side of the dam, which is upstream, is curved with a radius of 637 feet.

ENOS BROWN.

GUNS RECOVERED FROM THE SPANISH CRUISERS.

There has recently been brought up from Cuba, and unloaded at the Washington navy yard, a considerable amount of material which was recovered by the wrecking companies from the wrecks of Cervera's fleet. It is a miscellaneous collection of guns, gun shields, projectiles, chains, ship stores, and general fittings.

The most conspicuous part of the salvage is the breech-loading rifles, from the secondary batteries of the Spanish cruisers, and the shields and mounts which accompany them.

Our illustrations are from photographs taken at the Washington navy yard, soon after the material had been unloaded from the United States collier "Leonidas," and it will be seen that the trophies carry upon them the unmistakable mark of the two agents, shell fire and conflagration, which brought about the speedy destruction of the Spanish fleet.

The guns shown in our illustrations have been recovered from one or other of the three sister ships, "Vizcaya," "Maria Teresa," and "Oquendo." These vessels carried as their main armament two 11-inch rifles and ten 5½-inch breech-loading rifles. The 11-inch guns were in two turrets, one forward, one aft, while the 5½-inch guns were arranged in broadside, amidships on the main deck. In the case of the "Vizcaya," the 5½-inch guns were of the rapid-fire type, we believe, but in the other two ships they were of the old slow-fire pattern.

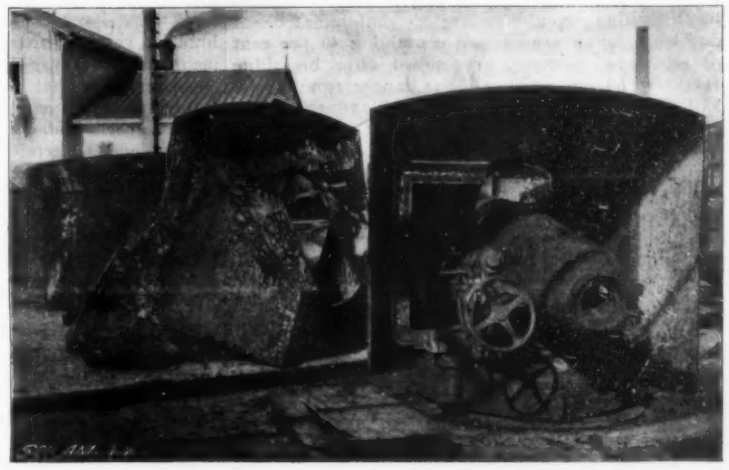
The 5½-inch guns are of what is known as the Hontoria pattern, of the year 1883. They have a total length of about 17 feet, the length of the bore being 35 calibers. The total weight of the gun is 4·1 tons, and it fires an armor-piercing projectile weighing 86 pounds and a common shell weighing 75 pounds. For the armor-piercing projectile the firing charge is 44·1 pounds of powder, which gives the shell a muzzle velocity of 2,001 feet per second, equivalent to a muzzle energy of 2,386 foot-tons. At the muzzle the penetration would be about 14 inches of iron.

The mounting is seen very clearly in the illustration (Fig. 2), showing the breech and inside of the shield of one of these guns of the slow-fire pattern. The gun is trunnioned in a top carriage, which travels during the recoil upon the slides of the lower carriage. The trunnions are formed on the gun, as is usual in all slow-fire weapons, and they can be seen on any of the dismounted guns shown in our various engravings. The lower carriage rotates upon a circular bed of rollers, below which, encircling the foundation plate of the mount, is a circular vertical rack, the rollers and rack being protected from projectiles by a circular casing which is bolted to the carriage and rotates with it. The upper and lower carriage, the turn-table, and the rack, without the casing, of one of these mounts, are shown in the lower right-hand corner of cut No. 1.

The gun is traversed to right or left by means of the hand wheel to the left of the breech, which, by means of a worm, worm-wheel, vertical shaft, and a pinion engaging the circular rack, rotates the carriage about the rack, the latter, of course, being bolted to the stationary foundation plate. The elevation and depression of the gun is accomplished through another hand wheel which acts on a pinion and a circular vertical rack attached to the gun.

Two of the circular racks are shown in Fig. 3, resting upon a dismounted Spanish gun.

All of the guns were provided with shields of comparatively light construction, the thickness, even at the vertical front end, not being over one inch. They are carried on the bottom carriage, to which they are attached by bolting at the front end, and by means of a square frame of angle-iron, which passes round the interior of the shield and extends inwardly to meet the carriage, to which it is bolted. These shields are of sufficient size and thickness to protect the gun crew from machine bullets at close quarters, and from one and six-pounders at long range; but, for protection against anything above a machine gun at close range, or above a six-pounder at any fighting range, these light shields are worse than useless. They cannot keep out the shells, and they merely serve to afford sufficient shock to burst a shell, which, but for the shield, might pass harmlessly by without striking any of the gun crew. In any case, it is not likely that more than one member of the detachment would be struck, whereas a shell that burst in passing through the shield, might kill every man at the gun.

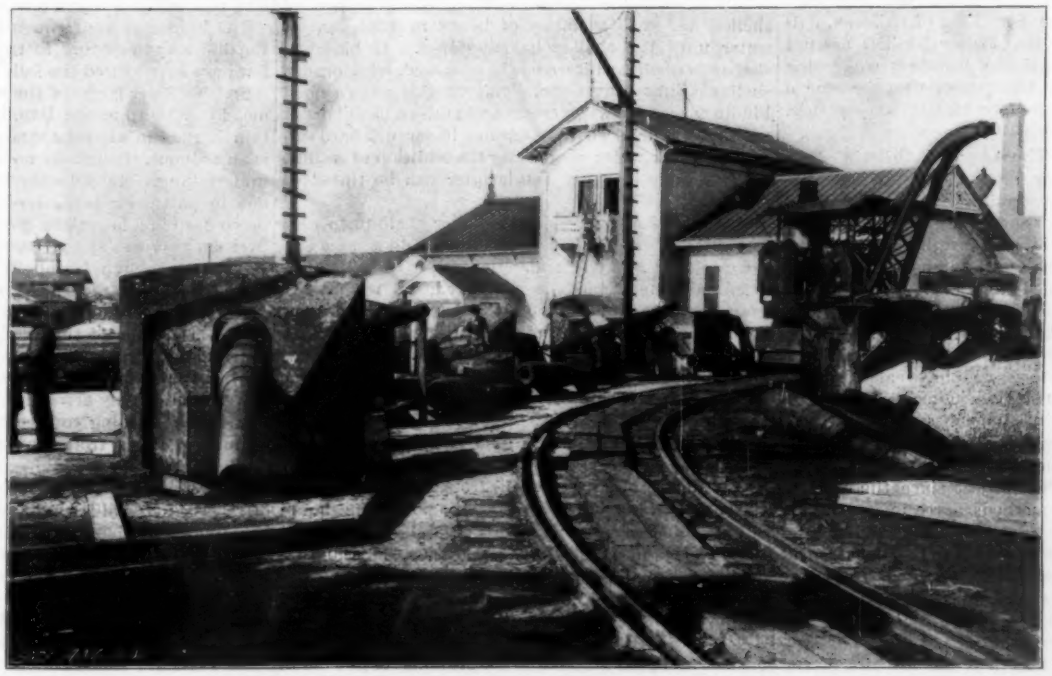


2.—VIEW SHOWING BREECH AND MOUNTING OF A 5½-INCH GUN.

The third shield (from the "Vizcaya") shows effect of shell passing through from the inside.

All the guns bear evidence of the attempt of the Spaniards to render the guns valueless before they fell into the enemy's hands. It will be noticed that the breech-blocks are all missing. They were unhinged and thrown into the sea before the surrender. If our government wished to use the guns, however, it would be easy to replace the blocks, as the Navy Department has drawings of them on file.

It is not likely that any of these guns will be put to active use, for it would entail the introduction of another size of ammunition into the navy, where there is a natural desire to keep down the number of different patterns of guns to the lowest practicable limit. It is not unlikely that the guns will be mounted as trophies at the Naval Academy, and in various public places throughout the country.



3.—SPANISH GUNS, WITH THEIR MOUNTS AND SHIELDS, AT THE WASHINGTON NAVY YARD, TAKEN FROM THE SPANISH WRECKS AT SANTIAGO.

A BROKEN-WINDED horse is rarely seen in Norway. A bucket of water is always placed within his reach when feeding, and the animal alternately takes a mouthful of hay and a sip of water.

Science Notes.

Bright red spectacles accompanied by internal doses of calomel form a new German specific against seasickness. It is deduced from Epstein's investigations on the influence of color on the blood vessels in the brain. Seasickness is due to lack of blood in the brain, while red sends blood to the brain with a rush. By looking at one point for some time through the red glasses, the patient is cured radically.

The number of bacteria in London crude sewage is 3,899,000 per cubic centimeter, at the Barking outfall, and 3,527,000 at the Crossness outfalls, according to the average of a number of recent counts by Dr. A. C. Houston, made early this year, under the direction of Dr. Frank Clowes, Chemist of the London County Council. The range at Barking was from 7,260,000 on May 3 to 513,000 on April 15; and at Crossness, from 5,290,000 on March 2 to 2,410,000 on April 20.

According to The Druggists' Circular and Chemical Gazette, the expensiveness and want of durability in the ordinary rubber bottles and ice bags which have been so essential in the sick chamber have long been a perplexing problem. Experiment with rice paper, covered inside and out with a coating of Japanese lacquer, led Prof. Jacobsohn to recommend this material to the Berlin Society of Internal Medicine as far superior to rubber. In strength, flexibility, imperviousness, lightness, and durability it is said that this bottle leaves little to be desired.

The increasing use of acetylene as an illuminating gas and the objection made to it in some quarters on the score of hygienic considerations lend particular interest to a number of experiments recently made on animals, says The Pharmaceutical Era. Dogs were kept for some time in an atmosphere containing 20 per cent of acetylene without deleterious effect, and it would appear that living beings are not injured by breathing an atmosphere so contaminated. A dog kept in an atmosphere containing 40 per cent of acetylene, however, succumbed after breathing 110 liters of the mixture. The danger from acetylene is smaller than from ordinary illuminating gas, and its intense odor makes it readily noticed when escaping into the air. There is no risk of explosion until the air contains one-twelfth of its volume of acetylene. It is particularly adapted to illumination, because of the slight heating effect as compared with its illuminating power, and the removal of but little oxygen from the atmosphere. The heat of combustion with an acetylene flame does not rise above 900° C., while the heat from an ordinary gas flame may reach 1,300° C.

It chanced that the birth-rate began to decline in France sooner than in other great countries of Europe, and that the decline has been more rapid. But, as the figures of the Registrar-General show, the same tendency is now very strongly marked in England, and is plainly visible in nearly every European country. It is quite conceivable that a couple of generations hence Frenchmen may find that their birth-rate is no longer the lowest in Europe. The truth is that the present rapid growth in European populations is a phenomenon which is almost entirely confined to the last 150 years. Through some of the grandest periods of our history the population of England was almost stationary, and the same statement applies to France. If this decrease is due to non-natural causes, it is not a matter for congratulation; but if it means that European peoples are ceasing to contract reckless and improvident marriages and are showing more care and discrimination in the begetting of children, it is a healthy sign of the times. Large families are not necessarily an evil, but if the members composing them are diseased and degenerate, they become a standing danger to the welfare of the body politic. —The Humanitarian.

In a recent paper on "The Accepted Altitude of the Aurora Borealis," read by Prof. Cleveland Abbe before the American Philosophical Society, he stated that some observers have seen the light in such positions between themselves and neighboring objects as to demonstrate that the aurora, like the lightning, may be entirely confined to the lowest stratum. Others have seen it so located among the clouds that its origin must be placed at or below their level, and therefore within a few thousand feet of the earth's surface. On the other hand, those who have calculated the altitudes of specific beams by trigonometrical or equivalent methods have deduced heights of twenty to a hundred miles; Dr. Boller has even quoted an altitude of 1243 miles. Prof. Abbe remarks that, after reviewing the literature of the subject since the time of Halley, he finds that all methods agree in one fundamental assumption that the observed beams and arches have an individual existence and a definite locus. But this assumption is negatived by the equal frequency of negative and positive parallaxes wherever the parallax method is applied. The only conclusion possible is that the observers do not see the same object, partly because the aurora is too low down, and partly because there are optical illusions due to alignment.

Miscellaneous Notes and Receipts.

Perfumed Ammonia Scouring Water.—Perfumed ammonia scouring water is prepared by mixing:

Spirit of sal ammoniac	160 parts.
Finely scraped soap	30 "
Borax	10 "
Cologne water	15 "

Distilled water, enough to make up 460 parts of liquid.

—Neueste Erfindungen und Erfahrungen.

Improving the Air in Work Rooms, etc.—For one liter bottle of well water, take a spoonful of oil of turpentine, shake the liquid diligently until it becomes dim or white and distribute in the room, by means of an atomizer. One may also mix a few drops of acetic ether with the oil of turpentine. The refreshing effect of the quickly spreading, pleasant odor is astonishing. —Kraft und Licht.

To Render Fine Fissures in Tools, etc., Visible.—In order to make the extent of fine cracks in tools, etc., visible, it is recommended to moisten the surface of the cracked article with petroleum, to rub off clean and to wipe off the surface with chalk. The petroleum which has entered the fine cracks sweats out and the rent is visible in its whole extent.—Oesterr. Zeitschrift fuer Berg- und Huettenwesen.

Lustrous shoe grease is obtained as follows, according to Technische Berichte: Alcohol, 126 parts; camphor, 11 parts; Venetian turpentine, 16 parts; shellac, 36 parts; dyestuff, 32 parts. The latter may either be aniline blue, of which it is best to use 15 parts, or Bismarck brown (phenyl brown), likewise 15 parts; both coloring substances are dissolved in 800 parts alcohol. This polish is best suited for walking boots and shoes, since it possesses a fine, silky (not a lacquered or mirror-like) appearance.

Technical Value of Acacia Wood.—The fact that the locust tree attains in twenty-five to thirty years the same thickness as the pine in fifty and the oak in one hundred years caused L. Kausch to conduct experiments with this variety of wood. The author gained the conviction that acacia wood has an important future, especially as regards its use for mining purposes. Acacia timber excels by great firmness and durability, and is, therefore, also well suited for many other purposes, such as wheels, bungs, ladder steps, etc. The locust tree thrives in the poorest soil, even in the rubbish of sandstone quarries and in slaty declivities. All that is necessary is to make a little hole in the latter, to fill it with mother soil, and to plant the young tree therein. In wet soil the locust tree does not thrive.—Glück Auf.

New Painting Ground.—Since notable connoisseurs ascribe the subsequent darkening and defective luminosity of many paintings to the composition of the grounding with which the canvas is prepared, J. L. Schudt, in the Polytechnisches Zentralblatt, proposes in place of the mixture now employed, consisting of chalk, glue, and oil, a new composition, which he prepares as follows: Slake burnt lime with a little water, add to the mixture, while still hot, beeswax and linseed oil, and grind the whole in a paint mill with 1¼ to 1½ times its weight of white cheese. The mass is applied on the canvas saturated with milk and smoothed. Another advantage claimed for this new painting foundation is that it does not allow cracks and fissures to form as readily as with the one heretofore in use.

Water Lacquers.—The group of the water lacquers embraces only a few, little used lacquers. Below are some receipts.

1. Shellac Water Lacquer.—Boil 28·5 grammes of shellac and 42·75 grammes of borax in 0·564 liter of water until the shellac has dissolved. If bleached shellac is used, a white color is obtained, with orange shellac a light brown one. This varnish gives a good binding agent for water colors and is also a useful paper varnish. It dries with a handsome luster and hard surface which is water proof. By the addition of aniline colors soluble in water, the lacquer can be tinted as desired.

2. Enamel Lacquer.—Mix 0·564 liter of albumen with 0·564 liter of water. For preservation, add a little carbolic acid or salicylic acid. Instead of the albumen, dried albumen may be employed, of which 28·5 grammes are dissolved in 0·564 liter of water, but the color is less clear. This varnish dries with good gloss. By drying in hot air it becomes more resistive to water.

3. Glue Lacquer.—Dissolve 1 pound of good pale glue in 9 liters of water, the color being entirely dependent on the quality of the glue. Good white gelatine gives a white color, while brown glue yields a yellow one. Solution accomplished, add (but only directly before use) 28·5 grammes of potassium bichromate, which renders the surface watertight. As said, the potassium should only be added closely before use, else the solution will be converted into a gelatinous, stiff mass. This mixture constitutes the basis of many leather varnishes. For preservation the addition of a little thymol or borax is commendable.

4. Crystal Water Lacquer.—Dissolve 450 grammes of good white gum arabic and 450 grammes of glucose in 1,629 liters of water. This solution dries hard and glossy.—Färben Zeitung.

PATRICK COUNTY, VA., AND ITS CURIOUS "FAIRY STONES."

BY POWHATAN BOULDIN.

The Blue Ridge and the Alleghany Mountains unite a little north of the county of Patrick, Virginia, and hence in that county they constitute only one mountain.

Stuart, a pretty little town seventy-five miles west of Danville, is the county seat of Patrick and the terminus of the Danville and Western Railroad. The distance from Stuart to the top of the mountain is ten miles, over an admirably constructed turnpike, and the scenery all along the road is exceedingly picturesque. When the traveler reaches the summit of the mountain, 3,000 feet above the level of the sea, he naturally expects to descend on the other side; but, greatly to his surprise, he finds himself in a comparatively level country, the soil of which is well adapted to the cultivation of grain, grass, and vegetables.

That portion of this remarkable plateau which lies in the county of Patrick is called the Meadows of Dan. In the meadows are innumerable springs of pure water, the temperature of which is 50 degrees in summer. In less than fifteen miles the traveler crosses twelve different streams, all rising on the top of the mountain, and all flowing through these beautiful tablelands. One of these streams (the river Dan) joins the Staunton and forms the Roanoke, which empties into Albemarle Sound. Another (the Ararat) flows into the Yadkin, which joins the Great Pee Dee, in South Carolina, and with this runs into the Atlantic Ocean. The waters of another empty into New River and finally reach the Gulf of Mexico.

So it appears that these streams, which rise so near together, are wide apart before they reach the ocean.

The Dan, making its way down the mountain, is a very great natural curiosity. After flowing about ten miles through meadows, it reaches the declivity of the mountain and begins to descend, making innumerable picturesque waterfalls in its downward course. One of these is known as the Big Falls. There the water flows between two high mountains and falls in a beautiful, smooth sheet over a huge rock 40 feet high. At the base of the falls is a basin of water, clear as crystal and extending 25 feet under the rock over which the water falls. This basin is nearly round and is 60 feet in diameter. The beauty of the falls, together with the wildness of the scenery, make it a very romantic place. But the most remarkable thing about the passage of the Dan down the mountain is the marvelous zigzag course which the river takes in making its descent. The distance in a straight line is only five miles, but, following the river, as it winds round the deep gorges, hemmed in on all sides by high mountains, it is at least twenty miles.

One mile below the Big Falls are the Pinnacles—two immense natural pyramids in the shape of a sugar loaf, rising to a level with the surrounding mountains. The summit of the highest one is about 20 feet square, and from it a view may be obtained which will amply repay the visitor for the labor of climbing, although that labor is very great.

The Dan runs entirely round the Pinnacles, taking one at a time. The distance straight across is only half a mile; but, following the river, it is at least two miles. When the river reaches the foot of the mountain the scene is suddenly changed, the waters becoming calm and placid, and the visitor, who has seen the mad rush and heard the mighty roar, has the inexpressible feeling of quiet which is experienced by one who has passed through a terrible storm.

The Pinnacles are frequently visited; but, owing to the difficulty in getting to the river and following it, few have ever visited the falls of the Dan.

Smith's River is one of the streams which rise in the meadows. Unlike the Dan, in descending the mountain it runs in almost a straight line, and following it is an arduous, though by no means an impracticable, undertaking. Many pretty cascades are to be seen, one in particular being especially attractive. This is down deep in a mountain gorge, where the river flows over a large rock, at the base of which is a little level spot, large enough for about a dozen persons to stand and admire the scene. As the rock is not perpendicular, the water does not make such a loud noise as at the Big Falls of the Dan, but instead a low, murmuring, melancholy sound, which is as soothing to the soul as the softest, sweetest strains of music. Such a retreat is not only attractive to the romantic youth, but it is refreshing to men of mature years who may be in need of rest from the cares and responsibilities of business.

In the meadows, near the head waters of Smith's River, rock crystal is found, out of which the Indians manufactured their prettiest arrow heads. The writer has one made of that material which is so perfectly transparent that the smallest print may be read through it. The writer has seen many arrow heads which were made of white flint, but this is the only one he ever saw which was made of rock crystal.

In the same vicinity there is a quarry of very fine soapstone. Near it was recently found a large bowl, which some Indian sculptor had made of that material;

also a soapstone pipe and stem, handsomely finished, was picked up in that neighborhood. How the Indians, who knew nothing of the use of iron tools, made such a pipe and such a beautifully shaped arrow head, is a question which has never been satisfactorily answered. Such relics should be carefully preserved, for they are the only memorials we have of the race which first inhabited this country, the race from which sprang Pocahontas, the gentlest savage that ever lived.

All the things that I have enumerated are highly interesting, but nothing that I have seen in Patrick County has interested me so much as its fairy stones.

These curious little crystals are found in only three other States besides Virginia, in no other county in Virginia but Patrick, and nowhere else in Patrick but on and along Bull Mountain, a spur of the Blue Ridge running twenty miles through the county. The fairy stones found elsewhere, judging from the specimens exhibited at the Atlanta and Nashville expositions, are not at all comparable to those found on Bull Mountain. To a few of the people of Patrick they have been known for a long time, but not until about ten years ago did they come into public notice. Some of these stones which have been analyzed contained titanite, tourmaline, garnet, aluminum, and steatite, titanite being the principal material.

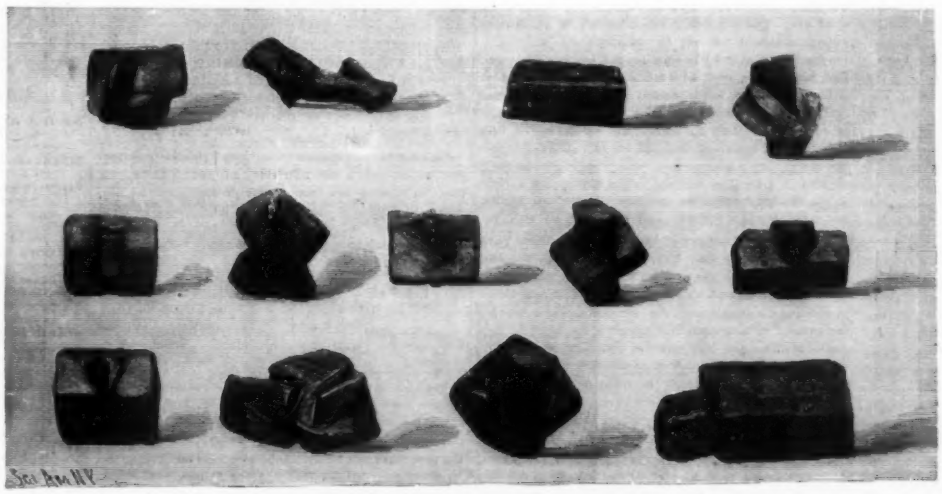
Geologists say that they are crystals. Most of them have crosses, some what is called the Roman; some, the Maltese; some, the St. Andrew's; and some, crosses for which there are no names. Those which have no crosses are pretty stones of different forms. Frequently two, sometimes three or four, are joined, making a most curious combination. Possibly a person skilled in the use of the chisel might imitate what might be styled the plain work of the fairies; but it would be impossible for the most skillful sculptor to imitate their fancy work. On many of these stones there are crosses exactly alike on opposite sides. Some of the stones are not larger than the head of a pin, while others weigh as much as an ounce and a half. No two are alike. Nature seems to have tried her hand at variety in making them, as she does in making the leaves on the Otahite mulberry tree. And they are of every shade of color. A number of them placed upon a cardboard make a picture as novel as it is strange and beautiful. No adequate conception can be formed of what a great curiosity fairy stones are without seeing a great many of them together.

Hunting for fairy stones is a new and charming diversion. A walk of two and a half miles from Stuart will take you to where they are found. You will have to climb the mountain, but the scenery along the route is so picturesque that you will forget you are going uphill. And, besides, you will be constantly thinking: What shall I find? Will it be a Roman, a Maltese, or a St. Andrew's? Or will it be a Roman joined to a Maltese or a Maltese joined to a St. Andrew's? or a St. Andrew's joined to one of the crosses for which there is no name? Of one thing you may rest assured, and that is, that every stone that you may find will be different from any that you have ever seen.

When you arrive at the place (it is only about in spots on Bull Mountain that fairy stones are found), you will begin at once the search. You will find them from two to four inches under the ground, and the best instrument to use in digging them up is a small trowel. You will find them in abundance; but the really pretty ones, such as are used by ladies for scarf pins and by gentlemen for watch charms, are scarce. All of them, however, are interesting specimens of the most curious form of crystallization.

When you have filled your pockets, you start back; but you will not go far before you will be tempted to take a seat on one of the large, flat rocks on the side of the road—not to rest, for it is now facilis descensus—but to gratify the curiosity which you are sure to have to look over your treasure. Taking out your fairy stones and inspecting them, one by one, you will discover in many of them beauties which escaped your notice while you were digging them out of the ground.

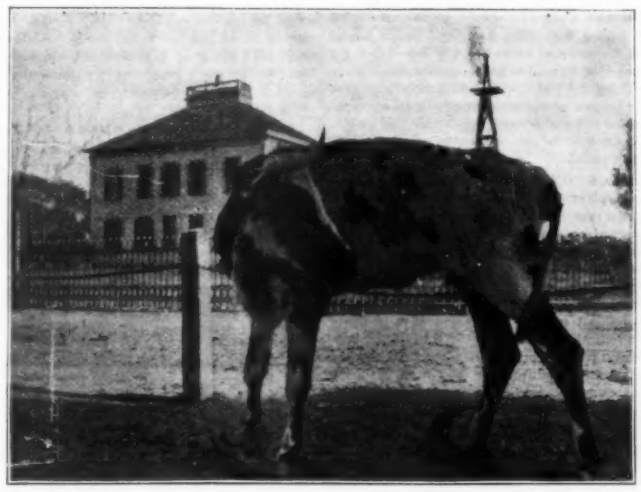
Having gratified your curiosity, you resume your walk, and are soon back again at Stuart.



PECULIAR SHAPED "FAIRY STONES."

A CURIOUS CASE OF MALFORMATION.

Through the courtesy of Mr. W. O. McCurdy, publisher of The Beeville Bee, of Beeville, Texas, we are enabled to present our readers with one of the most remarkable curiosities in the way of animal malformation that we have seen for years. The cow shown in our engraving is five years old and is the property of W. J. Miller, a ranchman of Bee County, Texas. Since its first year its hoofs have been growing until they are now about fourteen inches in length and shaped as shown in the photograph. As it may be supposed in cattle-growing countries, the ranchmen have been very much interested in this strange-looking animal and they are unanimous in stating that this is the first instance on record of such a malformation. The cow has given birth to one calf, which has in no way inherited the peculiarity of its mother.



CURIOUS CASE OF MALFORMATION IN A COW.

A Traveling Railway Library.

The Baltimore and Ohio Railway has a traveling library for the exclusive use of its employés and their families, containing 14,000 volumes. This library was started in 1885 with 4,500 volumes, 3,000 of which had been purchased, the remainder donated. The headquarters of the library is in Baltimore, from which current periodicals and standard works on science, general literature, poetry, history, and other books of practical utility to railway employés are distributed to any point on the B. & O. lines. The books are delivered to borrowers through local agents. The average time from the placing of an order for a book in the hands of an agent until the book is in his hands for delivery is officially stated to be less than twenty-four hours for the entire system, which comprises 674 agencies, extending over 3,000 miles of line, through eight States, and as far west as the Mississippi River. According to the rules of the library, a book may be retained two weeks, after which it will be once renewed for a like period, upon request, if no other application for it is on file. There is a fine of one cent per day for books kept over time, a margin of three days being allowed to cover the time consumed in transit. Upon leaving the service of the company all books must be returned before pay vouchers are cashed; otherwise the price of the book is deducted from the wages of the employé. The management of the library is intrusted to a committee composed of two members of the relief department of the road and a representative of the railway company appointed by the president, who also appoints the librarian. The library is sustained by voluntary contributions of money and literature from the officers and employés of the railway company and outside friends interested in their welfare. The circulation increased steadily from 16,120 volumes in 1885 to 39,505 volumes, loaned to 2,500 borrowers, in 1896. The figures for the last two years are not at hand. The circulation of books of fiction has decreased from 64 per cent of the total circulation the first year to less than 53 per cent at present.

Elastic Leather Varnish.

Elastic leather varnish which does not break is prepared as follows: Colophony, 30 parts; thick turpentine, 30 parts; oil of turpentine, 30 parts; sandarac, 60 parts; shellac, 120 parts; alcohol (90 per cent), 900 parts. After all is dissolved, filter the liquid and, if black varnish is desired, mix with 15 parts of fine lampblack, which is previously ground with a little alcohol. If another shade than black is desired, use instead of the lampblack a sufficient quantity of some other color, such as Krems or zinc white, ultramarine, chrome yellow, or vermilion. — Neueste Erfindungen und Erfahrungen.

A Market for Our Meats.

Germany's meat famine is spreading apace. In many places, notably in Saxony, cats and dogs are being slaughtered and eaten by the poor. In some villages several families club together and buy a fat dog, to be killed and divided among them. The consumption of horseflesh is increasing phenomenally. Horseflesh butcheries are being established in towns where they have never existed before. There has been a continuous increase of arrests and convictions for selling unwholesome ordinary meats since the frontiers have been closed against foreign cattle and swine. On the other hand, there is a great and thriving trade in preserved American meats, despite the government's obstacles at the instance of the Agrarians. The tinned American meats imported during the first seven months of 1898 amounted to 1,964,800 kilogrammes [a kilogramme is about 2¼ pounds], against 1,414,900 in the corresponding months of 1897. Of fresh pork the importation was 6,758,800, against 3,955,500; of pickled pork, 3,369,900, against 1,859,800; of bacon, 15,948,300, against 7,139,300; and of lard, 64,356,400, against 47,446,600. The demand for all of these still exceeds the supply, and if the general mass of Germans can be convinced that American meats are always of standard quality and can be had at a reasonable price, the sales can be extended fivefold.

The Current Supplement.

The current SUPPLEMENT, No. 1198, is commenced with an illustrated description of the Argentine cruiser "General Belgrano," which is a handsome and highly efficient armored cruiser of the latest type. "The Steam Yacht as a Naval Auxiliary," by W. P. Stephens, is an interesting article. "Roman Construction," by G. W. Percy, is an archæological and engineering paper. "The Use of Aluminum in Warfare" is a paper of value. "The Opening of the First Section of the Jungfrau Railway" describes the progress which has been made on this important engineering work. "In the Land of Ginger—Jamaica," is a paper by F. B. Kilmer. "The Races of the Philippine Archipelago" is an illustrated paper by Dr. Daniel G. Brinton and is of great interest. W. O. Atwater's "Dietary Studies" complete the paper.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CULTIVATOR.—LOUIA W. GRAUERHOLE, Kensington, Kans. The purpose of this invention is to provide a machine especially adapted for the cultivation of corn, which machine is so constructed that two rows of corn may be cultivated at one passage of the machine across the field. The invention enables any desired number of plows to be carried by each cultivator-beam, or permits the use of a single set of plows, if desired. The plows may, furthermore, be adjusted relatively to the ground and may be speedily returned to the soil, should they meet with an obstruction, the return taking place almost instantly after the obstruction has been passed.

Bicycle Appliances.

BICYCLE-ATTACHMENT.—JOSEPH W. SATTERTHWAITE, Mingo Junction, Ohio. The attachment forming the subject of this invention may be secured at the front of the bicycle, and comprises a frame capable of being removed and secured to the bicycle handle-bars and steering-head. The frame has a support upon which a child or any other load may be carried.

SOCIABLE BICYCLE.—WILLIAM F. WILLIAMS, London, England. This bicycle has a single central main frame on which a transverse laterally-adjustable frame, which supports seats for passengers or receptacles for goods, is mounted to slide. A rack-bar couples the saddle-supports so that these supports may be moved together. A self-locking pinion effects the lateral adjustment of the saddles and retains them in position. A supporter is provided to hold the bicycle in an upright position when the riders are mounting or dismounting. The weight of the riders and load may be adjusted so as to balance unequal weights.

Engineering Improvements.

ROTARY ENGINE.—WILLIAM MOHR, Kurtz, Ind. The rotary engine of this inventor comprises a continuous cylinder having a steam-chest and a separate exhaust-chamber. A rotating piston extends with its rim into an annular slot in the cylinder-wall, and is provided with oppositely-arranged ports, one of which is the inlet-port. A piston-head is carried by the piston and extends into the cylinder. In the cylinders abutments slide. A reversing valve on one face of the piston is arranged to uncover one of the piston-ports to the steam-chest, to allow the steam to pass through the uncovered port into the cylinder. The reversing valve, moreover, is formed at its inner face with a cavity for connecting the covered-up piston-port with an exhaust-port formed in the piston and leading to the exhaust-chamber.

Railway Appliances.

SWITCH.—GEORGE A. and THOMAS F. PENROSE, Meredith, Ark. The switch of these inventors has switch-points operated by an ordinary switch-stand, but constructed without the usual frog, the switch having, instead, means for lifting the wheels of the car from one rail to another. With the main and switch rails are connected a swinging wheel-lifting rail, forming a continuation of one of the switch-rails and overhanging the adjacent main rail. Two guard-rails are mounted to swing on independent axes adjacent to the wheel-lifting rail, the connections converging and extending to a common point on the wheel-lifting rail, at which point the connections are pivoted to the wheel-lifting rail, whereby the movement is directly transmitted to the wheel-lifting rail. A train passing over the tracks will be caused to take the switch by the action of two switch-points, the one serving to slide the train laterally toward the switch and the other serving to lift the corresponding wheels up from one rail to the other.

Mechanical Devices.

MACHINE FOR CONSTRUCTING IRRIGATING OR OTHER FLUMES.—JOSEPH H. MARTIN and DAVID ORMAND, Riverside, Cal. In this machine are provided a mold for the flume, a hopper connected with the flume, a paddle mounted in the hopper and adapted to distribute the concrete delivered by the hopper in the mold, and a plunger mounted to slide in the body and in the mold-section, and operated by a lever to pack the concrete firmly together after it has been delivered by the hopper. The plunger's being resisted by the concrete already packed will cause the whole machine to be moved on.

MORTISING OR GANG-DRILLING MACHINE.—ABRAHAM VAN WAGNER, New York city. It has been the object of this inventor to provide a device so small in cost and yet so effective in operation, that small shops unprovided with the usual large, costly mortising machines, may be enabled to produce work far more quickly than has heretofore been done by hand. The device comprises a frame consisting of legs secured to a table. The edges of the top member have guides which receive bars carrying the operating mechanism. Upon the top member an adjustable knee adapted to support the work, is secured. In order that the drills may be raised, a lever is provided, pivoted upon a bracket and connected with two links. The drill sockets are made to turn all in one direction by means of a series of pinions rotated by a gear-wheel. The machine is operated by foot-power.

ENVELOP MOISTENING, SEALING, AND STAMP-AFFIXING MACHINE.—HARVEY P. JONES, Chicago, Ill. On the water-tank of this machine is arranged a guided moistener to dampen the envelop-flap. After having been moistened, the flap is sealed by a device consisting of two yieldingly mounted plates, located between side bars. Springs bear between the plates and the side bars; and a presser mounted to swing between the plates presses the flap against one of the yielding plates to seal the envelop. After the envelop has been sealed, a stamp is moistened by a special device and applied.

PRINTING AND FOLDING MACHINE.—JOHN A. PYROS, Chester, Ill. This machine consists essentially of a printing mechanism and a folding mechanism. The printing mechanism consists of a plunger by means of which the printing is accomplished. The type having been inked, the plunger is raised, and a piece of paper placed in position. After having been imprinted, the paper is acted upon by a folding strip controlled by a spring-roller. Plates located in various positions act on the paper to assist the folding strip in folding the paper in any desired shape. Although the machine is designed to print and fold labels used on mail-pouches or sacks, it may also be used in printing and folding circulars and the like.

TRACTION-WHEEL.—JEREMIAH J. GILLINGER, Quitman, Mo. In this traction-wheel, the opposite hubs of the main wheel are connected with a shaft extending through and between the hubs and carrying a fly-wheel between the shaft and main wheel. The power may be derived from electricity, gasoline, or any other motive agent.

Miscellaneous Inventions.

DEVICE FOR REMOVING DRILLS FROM WELLS.—FRANK M. KISER, Parkersburg, West Va. This invention provides a device designed to assist in the recovery of drilling tools when they have become bound in wells by the caving of the walls. The device used for this purpose comprises a bowl attachable to the bottom of the well-casing. The bowl has an interior cone surface at its bottom acting in connection with a clutch-dog. This dog is forced between the tool and the wedge-surface so as to bind the two together in order to enable the tool to be raised.

PRAYING OR CONFESSIONAL STAND.—HERMAN F. NEHR, New York city. The stand of this inventor is so constructed that the praying bench may be adjusted expeditiously and conveniently to suit all requirements. The reading desk may be adjusted to or from the occupant of the stand. The body-portion of the stand, or that portion which supports the praying bench, may be raised or lowered. The front and rear supports for the stand are arranged so that they may always be maintained in a vertical position or parallel with one another. An attachment for the reading desk is provided whereby a screen may be elevated from the desk at the front for confessional purposes, and held in its elevated position. When the screen is not required, it may be stored in a suitable receptacle beneath the reading desk.

CALENDAR-TELLURIAN.—GRANT B. NICHOLS, Wapakoneta, Ohio. This calendar-tellurian comprises a backboard or table having a series of marked apertures representing the elliptical path of the earth around the sun. The apertures correspond in number with the days of the year. A ball or globe representing the earth is held on a pin standing for the earth's axis and is adapted to be set in one of the apertures. An electric lamp carried by an inclined support is secured to the board at the center of the earth's orbit and represents the sun. Pointers are mounted to turn upon the central portion of the support and point to the name of the month and the day of the month, the names and days corresponding with sections of the earth's orbit. The calendar is arranged to indicate the month, the day of the month, the exact position of the earth relative to the sun on each day of the year, and the position of the earth in the zodiac. By means of the lamp, day and night may be correctly represented on the ball standing for the earth.

CARBURETER.—ELIJAH D. PARROTT, Golden Dale, Wash. A gasoline supply-tank is provided in this apparatus from which there leads a gasoline supply-pipe. An air supply-pipe is connected with the gasoline-pipe. A burner heats the pipes. Water is used to cool the gas. An air-pump forces the gas into the gasometer. Throughout the generating process, the gas is maintained of the same strength. The gasoline is uniformly consumed according to the number of lights in use. Frost cannot form on the inside of the generating apparatus, and freezing of the gas-mains between the lights and the carbureter is prevented.

JACK.—GEORGE A. and THOMAS F. PENROSE, Meredith, Ark. The purpose of this invention is to provide a jack designed for use on railroads to shift rails longitudinally in order to equalize the joints. The jack has two clamps, each with a key for fastening them to adjacent rails. A bar is pivoted on one of the clamps and is fitted to slide in the other. A lever is fulcrumed on the clamp in which the bar slides. A link is pivotally connected with the lever. A grip engages the bar in such a manner that, when standing at an angle thereto, it grips the bar, and, when moving at a right angle, the grip slides on the bar. A foot on the link holds the grip in a slidable position.

WAIST-BELT.—SAMUEL BIENENEUCHT, New York city. A waist-belt has been patented by this inventor which, while consisting of a series of links, permits the use of a yielding and a rigid material for alternate links. A yielding binding is used for the links, which binding is provided with integral eyes adapted for flexible connection with eyes formed upon the rigid links. The belt, though partially made of metal, will adapt itself to the figure as perfectly as a belt made entirely of softer material.

OIL-CAN.—ARTHUR C. HERSBERGER, Poolesville, Md. The body of this can has a neck, the upper end of which is engaged by the bottom plate of the spout, a washer being used to prevent the leakage of oil. At opposite sides of a downwardly extended peripheral flange of the plate, eyes or links are attached, to which a fastening device, consisting of an loop, is secured. By manipulating the loop, the spout-plate may be drawn tightly against the neck or removed laterally to permit the can to be filled. The invention does away with the old operation of unscrewing the parts in order to fill the can and is, hence, of especial service when used in connection with farm-machinery.

CHURN.—LEROY DRAKE, Shelton, Neb. This invention is an improvement in those churns which are made to rotate or oscillate, whereby the cream is alternately thrown from one end to the other and is caused to pass through a fixed, reticulated diaphragm for the purpose of quickly breaking the oily globules and inducing the formation of butter. The inventor of the present churn has devised an improved attachment for such churns, which attachment is in the nature of a collapsible diaphragm comprising two reticulated semi-circular parts flexibly connected. The diaphragm is firmly yet detachably held by means of a locking bar

NUT-LOCK.—SILAS CHAMBERS, Sterling City, Tex. In the nut-lock forming the subject of this patent, a simple washer or locking-plate is provided, which consists of a tongue formed with inner and outer wings, both of which are provided with openings for the operating tool whereby the tool may bear in both openings at the same time. The invention's especial merits are the ease of application and operation of the locking devices.

AMALGAMATOR.—MINNIE H. MACCLAY, Louisville, Ky. With a fixed frame, an ore-feed block having a vertical passage, and a float-gold arrester arranged in the passage and comprising a metal frame, are connected an oscillating mercury-box arranged beneath and partly inclosing this block and adapted to co-operate with the block, to scour and grind the ore. Hangers are provided for the box, and have knife-edge supports.

BOTTLE-CAP.—LOUISA G. FLANIGAN, Baltimore, Md. This invention furnishes a cap formed with a circumferential inturned flange around its upper and outer edge, which is adapted to receive the end of a tool to pry off the cap and which also makes a strong reinforced edge or crown for the bottle-mouth. With the cap is connected a disk or plate secured beneath the inturned flange and having a projecting thumb-piece or lug by which the use of a separate tool on removing the cap is not required.

PICKER-STICK ATTACHMENT.—FRANCIS M. HUTCHINSON, Mayfield, Ky. The picker-stick attachment for looms provided by this inventor has a pivoted casing adapted to receive a picker-stick. A loop is formed on the casing for the passage of a return strap. A hook formed on the casing above the loop receives the outer end of the return-strap. The picker-stick can be readily inserted in the casing and fastened therein after the desired adjustment is made.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

MANUAL OF THE CANVAS CANOE. Its Construction. By F. R. Webb, "The Commodore." New York: Forest and Stream Publishing Company. 1898. Pp. 115. Price $1.25.

We are always glad to review a book which gives practical directions for making things, and the present volume gives explicit directions for making an excellent canoe at an expense of $12 to $15. Full specifications and elaborate working drawings, numbering seventy in all, are given. The canoe proper is not only described, but the subject of repairs, camp equipment, conveniences, camp cooking, etc., are also treated. This excellent little book will be hailed with delight by all amateur boat builders.

HITTING VERSUS MISSING WITH THE SHOTGUN. By S. T. Hammond. New York: Forest and Stream Publishing Company. 1898. Pp. 170. Price $1.

This book might be termed "The Hammond System of Shooting," for Mr. Hammond enjoys among his field companions the repute of being an unusually good shot and one who is particularly successful in that most difficult branch of upland shooting, the pursuit of ruffed grouse or partridge. This prompted the suggestion that he should write for others an exposition of the methods by which his skill was acquired. The result is the original manual before us. We term it original because the chapters will show the author was self-taught; the expedients and devices adopted and the forms of practice followed were his own. The volume will be warmly welcomed by sportsmen.

COMMERCIAL RELATIONS OF THE UNITED STATES WITH FOREIGN COUNTRIES DURING THE YEARS 1896 and 1897. In two volumes. Volume I. Issued from the Bureau of Foreign Commerce, Department of State. Washington: Government Printing Office. 1898.

Commercial relations of the United States with foreign countries is a very important subject at the present time, in view of the fact of our present export trade, which is constantly increasing. The volume is filled with important information and tables. The statistics are carefully classified and are thoroughly reliable.

THE STATISTICAL YEAR BOOK OF CANADA FOR 1897. Thirteenth Year of Issue. Issued by the Department of Agriculture. Ottawa: Government Printing Bureau. 1898. Pp. 554.

The annual volume issued by the Department of Agriculture, termed the "Statistical Year Book of Canada," contains a short history of Canada, and then treats of its constitution and government, land regulations, events of the past year, agriculture, minerals, trade and commerce, currency and banking, railways and canals, post office, finance, insurance, education, Indians, patents, vital statistics, criminal statistics, and the organization of the present government. It is a valuable manual for all who are interested in any way in Canada.

We have just received the Fiftieth Anniversary number of our excellent contemporary, "The Independent." Having had a Fiftieth Anniversary ourselves three years ago, we know how pleasant it is to celebrate the half century of a successful newspaper. "The Independent" is always a welcome visitor to office or home. It is a clean and fearless journal and gives to the reader nothing but matter of the highest class. It is published in convenient magazine form, and the price for a single copy is 5 cents, and the subscription price is $2. The present anniversary number contains valuable articles by R. S. Storrs, Francis J. Higginson, Richard H. Stoddard, William Hayes Ward, Thomas Wentworth Higginson, Theodore L. Cuyler, Elizabeth Stuart Phelps, Edward Everett Hale, Cesare Lombroso, John La Farge, Justin McCarthy, Maurice Thompson and others. It would hardly be possible to obtain a more representative collection of writers. We heartily congratulate our contemporary on its Fiftieth Anniversary.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

About Elgin Watches.

Thirty-four years ago, it required no common courage for a body of men to invest their capital and devote all their energies to the founding of a watch factory in the then unknown village of Elgin, Ill., with any hope that its product should become more than locally popular.

The Elgin National Watch Company, established at that time and under these conditions, has long since demonstrated the wisdom and foresight of its founders.

Its reputation for making watches of the highest quality at consistent prices has gone round the world, and for many years its output has been sold in advance of manufacture.

Modern methods, inventive genius, making at their factories the machines with which watches are made, employing skilled experts—these are some of the facts that have made possible an output of nearly 8,000,000 complete and perfect timepieces from this great factory in the space of a third of a century.

A factory properly ventilated and lighted, congenial surroundings in home and factory life at Elgin have all conduced to the success that has ever marked the Elgin National Watch Company.

The Chicago Times-Herald, in its issue of September 5, 1898, speaking of the employes at the Elgin factory, mentions "the high character and intelligence of the operatives and their confidence in their employers, based upon long years of fair treatment," and adds, "It is perhaps not too much to say that the employes of the watch factory, both skilled and unskilled laborers, are the equal in every respect of any factory operatives in the country. Certain it is that they are far superior to ordinary factory workmen. One can tell their quality in a moment if he but takes the trouble to watch the stream of men and women moving toward the main gateway at the hour of commencing labor. The close and friendly relations which for so many years have existed between employers and employed have made the factory able to point with pride to a record of thirty-four years without either strike or serious industrial complication of any nature."

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7529) F. E. J. asks: 1. Can an electric arc be produced in a vacuum? A. We reply in general, an electric arc cannot be produced in a vacuum, if by it you mean an arc light such as is used for lighting; but in the low vacuum of a Geissler tube an arc of purple light may be produced several feet long. In the vacuum of a Crookes or X ray tube no electric discharge can take place, and a tube may be so perfectly exhausted that no discharge will pass between terminals only ¼ inch apart. 2. Will it burn as bright as though produced in air? A. No. When the vacuum, is low enough for an arc to form, the light of it is of a purplish tint and is visible only in the dark. 3. Would ordinary glass answer for a globe for an electric arc in vacuum? A. Ordinary glass is used for the bulbs of Geissler tubes; but glass without lead for X ray tubes. 4. Would it require more power to produce an arc in a vacuum than in the open air? A. Certainly; more power is required to drive the electric discharge across a given gap as the air is removed from it, until the point is reached when the discharge ceases to pass the gap at all. Moore's system of lighting employs the discharge through vacuum tubes. It is not extensively in use as yet.

(7530) H. B. C. asks: 1 What kind of varnish can I use to coat a wading suit with? It must be perfectly watertight and flexible. A. Dissolve 1 ounce

of beeswax in 1 pint of the best boiled linseed oil over a gentle fire, applying when cold with a piece of rag, rubbing it well in and afterward hanging up to dry, which will take four or five days; or paint with boiled linseed oil colored to suit. It must be done in very hot room or in a bright sunlight. A shoebrush is the best for applying it. A little patent drier may be added. It is said that the Chinese use a mixture of 1 ounce each of beeswax and soft soap with the oil, which is then boiled down. If the surface seems tacky, varnish with shellac varnish. In any case, apply the oil as thin as possible and let it dry perfectly between successive coats. 2. Which side of a leather belt should be run next to the pulley? A. All the best belt makers say run grain side to the pulley, and it is claimed that 33 per cent more power can thus be transmitted than with the flesh side next the pulley. The grain of the leather has a velvety surface, which enables it to hug the pulley closer than will the hard flesh side. Some users run the flesh side to the pulley for small belts, and then daub and stick up the belt with beeswax or resin to make it take hold, but this is not economical for the life of a belt, is unworkmanlike, and there is always more or less fussiness in running machinery where the belts are so treated, instead of their running for years without any attention, as they will sometimes do when run grain side to the pulley, and of proper size to transmit the desired power.

(7531) D. L. G. asks how to adapt an arc lamp suited for 52 volts and 12½ amperes to a circuit carrying 60 amperes at 104 volts. A. The arc lamp in question, when run on the 52 volt circuit, used probably 15 amperes and 45 to 50 volts, though perhaps it was wound so that it was put on the circuit directly at 52 volts. The 12½ amperes did not pass through the lamp. Such a lamp can be put on a circuit of 104 volts by supplying it with a rheostat whose resistance can be varied. It will require the same voltage and amperes as before. The other 50 to 54 volts will be taken up by the rheostat. This rheostat requires 200 feet of No. 12 (B. & S.) German silver wire. It should be arranged so that the coils can be cut out one by one to the last one, and then the current can be adjusted to the lamp. We advise you to call upon dealers in lamps of this kind.

(7532) J. J. W. asks: Could you advise the adoption of the storage battery instead of the trolley system for running a line of street cars from town out into the country? A. We regret to say that the storage battery has disappointed its friends in this respect. Even in cities it is not used, since it cannot compete in cost with the trolley. The trolley system is much cheaper, and on country roads there has never been any chance for the storage battery. There the overhead trolley is the best possible mode of electrical traction. In cities the open conduit underground trolley is at present considered the best. Gradually the town this is changed to the overhead trolley as in Washington, D. C.

(7533) W. W. asks: For an electric heater on 110 volt circuit, what size and quantity of German silver wire is suitable? A. If you wish to make a small heater to use about 1 ampere of current with German silver wire, get 1,800 feet of No. 18 B. & S. gage. For a heater using about as much current as an arc light, get No. 12 B. & S. wire and about 500 feet of it. For articles on electric heaters see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 513, 825, 1112, 1185, ten cents each.

TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

DECEMBER 6, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising device, J. W. Lynch 615,358
Air and gas mixer, J. F. Barker 615,320
Air brake, railway train, J. F. Voorhees 615,326
Air ship, F. B. Merritt 615,509
Airtight vessel, J. F. Davenport 615,478
Alarm. See Burglar alarm.
Alcohol, manufacture of, H. W. Wiley 615,376
Ambulance and tourist wagon, combined, C. H. W. Larrabee 615,396
Anticreosoting device, W. Weyerts 615,400
Asphalt, etc., apparatus for manufacturing objects from compressible material, such as, A. Pieper 615,373
Autographic register, Rauh & McNeal 615,306
Back pedaling brake, Mandleberg & Young 615,364
Bag. See Sleeping bag.
Baking or roasting pan, self-basting, Rinner & De Hart 615,638
Baling press, N. R. Wilder 615,402
Bandage rolling machine, Mullen & Shannon 615,298
Bar. See Cutter bar.
Barrel, O. H. P. Cornell 615,330
Basin or sink, hand, J. J. Wade 615,466
Basin, set wash, J. W. Grantland 615,387
Bath. See Shower bath.
Battery. See Electric battery.
Bearing, axle arm roller, G. F. Callaghan 615,662
Bearing, self-oiling, A. Weinhold 615,511
Bearing, shaft, G. E. Sovereign 615,507
Bell, bicycle, J. D. Lord 615,287
Bib, C. L. Maier 615,293
Bicycle attachment, C. F. Baiser 615,257
Bicycle brake, L. E. Clark 615,528
Bicycle carrier, T. C. du Pont 615,264
Bicycle handle bar, A. Ross 615,308
Bicycle lock, W. Bilyer 615,659
Bicycle luggage carrier and support, W. H. Marley 615,625
Bicycle pedal, A. Sidwell 615,505
Bicycle pedal attachment, A. Wagner 615,595
Bicycle step, A. R. Demory 615,533
Bicycle support, F. Dunham 615,612
Binder, order, C. A. O. Harwig 615,551
Binding post, J. P. Jones 615,455
Bit. See Bridle bit. Rosette cutting bit.
Black plate, manufacture of, W. H. Donner 615,535
Boiler. See Steam boiler. Tubular boiler. Water tube safety boiler.
Boiler flue cleaner, W. L. Casaday 615,427
Boiler furnace, steam, L. F. Lyne 615,291
Boiler mud and scale receptacle, steam, B. Haskell 615,549
Bolt. See Stay bolt.
Bolt holder, J. S. Higdon 615,273
Book fastener, L. W. Noyes 615,301
Boot or shoe polishing device, J. B. Miller 615,566
Boot tree, T. G. Stevens 615,330

Bottle, M. Fardy 615,348
Bottle holder and stopper, E. A. Parker 615,460
Bottle, non-refillable, E. Wilbur 615,601
Bottle opening or closing device, C. Kemper 615,487
Bottle or jar stopper, J. Rau 615,305
Bottle stopper, L. H. Broome 615,636, 615,637
Bottle stopper, F. L. Siegel 615,639
Box. See Match box. Packing box.
Box locking device, telescope, O. B. Hicks 615,552
Brace. See Ratchet brace.
Bracket support for toilet articles, A. O. Glock 615,484
Brake. See Air brake. Back pedaling brake. Bicycle brake. Car brake.
Brake handle, P. Flood 615,614
Bridle bit, J. P. Knight 615,283
Brush, Kelly & Linendoll 615,559
Brush, fountain, H. F. Haynes 615,617
Brush holder, tooth, Johnson & Guilfoyle 615,357
Buggy top supporter, F. J. Stallings 615,508
Burglar alarm, C. F. Cline 615,477
Burial apparatus, E. C. Jobson 615,620
Burner. See Gas burner.
Button, separable, W. P. Devine 615,609
Buttoner, R. Gans 615,482
Cab, hansom, Paradis & Desrosiers 615,633
Cam, double, Emmerich & Vonderlehr 615,441
Cane crusher, B. Thoens 615,590
Cane mill housing, B. Thoens 615,591
Car brake, F. O. Godman 615,353
Car coupling, J. M. Larkin 615,561
Car dumping apparatus, W. Hogan 615,554
Car motor, street, T. D. Hoskins 615,274
Car, railway, E. E. Pratt 615,575
Car, transportation, E. A. Trapp 615,373
Car ventilator, R. S. Howland 615,275
Carborundum and manufacture thereof, article of, E. G. Acheson 615,648
Carbureter, O. Owens 615,572
Carpet fastener, stair, H. L. Campbell 615,527
Carrier. See Bicycle luggage carrier. Elevated carrier.
Cartridge loading implement, S. B. Kitchel 615,282
Case. See Shelf block case. Show case.
Cash register, F. C. Osborn 615,469
Caster, ball, A. H. Cobb 615,529
Ceiling or floor plate, L. H. Snyder 615,641
Chain, C. W. Levalley 615,285
Circuit breaker, F. A. La Roche 615,395
Clamp. See Wagon box clamp.
Clay shingles, roofing tiles, bricks, etc., machine for pressing, A. B. Klay et al 615,560
Cleaner. See Boiler flue cleaner. Flue cleaner. Track cleaner. Wheat cleaner. Window cleaner.
Clothes line, W. W. Smith 615,314
Coat pad, C. W. Schweichler 615,500
Coating for metal surfaces, lead, G. H. Clamer 615,663
Cock, ball, T. R. Gleason 615,386
Cock or valve, gas, A. F. Bocquet 615,243
Cock, reversible waste, I. N. Glauber 615,366
Coffee roasting machine, Crawley & Johnston 615,252
Compound engine with regulator for superheated steam, W. Schmidt 615,311
Concrete mixing machine, W. C. Barr 615,519
Corn guide, J. Zimmermann 615,314
Corn or bunion plaster, H. H. T. Bennett 615,240
Coupling. See Hose coupling. Thill coupling.
Cover for vessels or receptacles, W. Ginalski 615,483
Cravat, C. W. T. Davies 615,435
Crayon or pencil holder, E. A. Shields 615,581
Crusher. See Cane crusher.
Crushing and pulverizing mill, F. G. Johnson 615,278
Crushing mill, roller, J. F. Webb 615,575
Cultivator, disk, J. L. Scott 615,576
Cultivator leveler attachment, H. G. Kounts 615,284
Curtain ring, J. Berbecker 615,339
Curtains or screens, means for raising or lowering door or like, W. Brecknell 615,605
Cutter bar, A. J. Anthony 615,253
Cyanids, apparatus for making, T. B. Fogarty 615,266
Cycles, etc., apparatus for reducing vibration in, F. Beauchamp 615,521
Dental plate, J. S. Nauider 615,404, 615,405
Dental saw handpiece and frame, J. F. Snedaker 615,316
Dock, pneumatic differential dry, C. N. Dutton 615,440
Door, B. A. Stevens 615,318
Door, flexible, A. S. Spaulding 615,464
Door hanger, K. Osel 615,492
Door lock, J. Ohring 615,571
Draught regulator and ash pit door, combined, W. Wewers 615,509
Dress stiffener, M. T. Sellers 615,579
Drill. See Rock drill.
Dust pan handle, adjustable, H. Marsh 615,565
Dye and making same, black trisazo, Ris & Simon 615,497
Dye and making same, green, E. Bourcart 615,472
Dye and making same, green, C. Hoffmann 615,488
Dyeing with quinonoxim colors, Alt & Culmann 615,232
Electric battery, O. T. Bugg, Jr 615,246
Electric battery, P. A. Emanuel ..... 615,539 to 615,541
Electric battery, M. Maas 615,292
Electric cable conductor, S. D. Field 615,349
Electric machine, alternating current dynamo, S. Z. de Ferranti 615,265
Electric machine, dynamo, J. E. Fuller 615,351
Electric switch, W. Ely 615,347
Electrical connection, W. E. Baker 615,420
Elevated carrier, C. H. Shipman 615,368
Elevated carriers, means for supporting ropes of, J. Temperley 615,370
Elevator, G. Holly 615,619
Elevator electrical appliance, J. H. Roberts 615,365
End gate, O. C. Sanger 615,306
Engine. See Compound engine. Rotary engine. Steam engine.
Excelsior, manufacturing, J. M. Titus 615,416
Fabric. See Fence fabric. Waterproof fabric.
Fastener, separable, G. E. Adams 615,336
Feed roll, M. M. Whipple, 2d 615,666
Feed water heater, C. Applegate 615,517
Fence fabric, mesh wire, W. A. Kilmer 615,281
Fence joint, wire, J. Harris 615,653
Fence post, J. Y. Propst 615,304
Fence post, A. Snell 615,585
Fence stay, wire, A. J. Munger 615,401
Fence wire, F. A. Curtis 615,360
Fender. See Plow fender.
Fibrous or absorbent surfaces, finishing, B. B. Goldsmith 615,446
Fifth wheel, E. H. Hungerford 615,391
Filter, J. A. Maignen 615,389
Fire extinguisher valve, F. Gray 615,354
Fire extinguishing sprinkler, J. H. R. Dinsmore 615,262
Fire sprinkler, F. W. Grew 615,270
Fish scaler, J. W. Court 615,432
Fishing reel, G. O. Brosnaham, Jr 615,526
Flooring, composition, H. Gallinowsky 615,352
Floors or similar structures, construction of, E. Pease 615,634
Flue cleaner, J. Cathriner 615,249
Flue cleaning apparatus, W. L. Casaday 615,428
Fluids, apparatus for treating, J. Whiteley 615,329
Fly screen, H. C. Loudermilch 615,289
Folding seat, A. E. Brockett 615,660
Fruit seeding apparatus, J. G. Gibson 615,615
Funnel, H. Altshul 615,337
Furnace. See Boiler furnace. Hydrocarbon burning furnace. Smelting furnace.
Furnace, J. J. & T. F. Meldrum 615,460
Furnace bosh plate, E. Kerr 615,456
Furnace for heating billets, blooms, etc., W. Swindell 615,465
Gage. See Sewing machine gage.
Game or puzzle, R. B. Barrows 615,469
Garbage and noxious gases, treating, J. A. Dubbs 615,439
Garment fastener, E. B. Nelson 615,303
Garment fastening device, J. V. Washburne 615,510
Garment, union, G. O. Cook 615,632
Gas apparatus, C. M. Gearing 615,385
Gas burner, incandescent, C. E. Lotz 615,288
Gas engines, supply controlling mechanism for, J. S. Klein 615,398
Gas generator, acetylene, M. D. Keiser 615,556
Gas lighting pellets, producing platinum, J. Perl 615,363
Gas lights, antivibration burner for incandescent, W. F. Rudolph 615,309
Gas manufacturing apparatus, J. M. Bois 615,527
Gas manufacturing apparatus, J. L. Hastings 615,450
Gas producers, coal feeder for, J. L. Hastings 615,451
Gate. See End gate. Railway gate.
Generator. See Gas generator. Steam generator.
Glass, ornamenting, C. P. Dorpolis 615,479
Glassware manufacturing apparatus, T. Coleman, Jr 615,608
Grain tank emptying device, pneumatic, F. J. Weber 615,328
Grinding round objects, apparatus for, C. A. & O. W. Hull 615,390
Gun mounting, L. V. Benet 615,522
Hame strap, T. E. Brockman 615,342
Handle. See Brake handle. Dust pan handle.
Hanger. See Door hanger.
Harrow, P. J. Heller 615,272
Hasp fastener, W. H. Smith 615,506
Headlight, locomotive, J. S. Thurman 615,372
Headlight reflector, A. Metternich 615,490
Heater. See Feed water heater.
Hemmer, R. S. Irwin 615,557
Hides or skins, machine for working, W. B. Turner 615,656
High frequency apparatus, T. B. Kinraide 615,652
Hinge, lock, M. C. Mulcahy 615,654
Hook. See Snap hook
Horse power, A. J. Boyce 615,473

(Continued on page 398)

Horse soaking boot, G. W. Dillon 615,437
Horseshoe, J. G. Parsons 615,308
Horseshoe, R. F. Spry 615,317
Horseshoe nails, machine for finishing forged, H. A. Williams 615,377
Hose coupling, W. E. Jones 615,279
Hub, wheel, A. Sirotich 615,440
Hurdle, J. Foster 615,443
Hydrocarbon burning furnace, C. M. Gearing 615,445
Impact tool, T. R. Browne 615,245
Incandescent light, Weisbach or other, T. Wilson 615,658
Indicator. See Office indicator.
Induction apparatus, high frequency, T. B. Kinraide 615,653
Iron. See Smoothing iron.
Ironing board support, C. M. Shaw 615,504
Jack. See Lifting jack.
Jar, S. Hipkins, Jr. 615,453
Jar, C. A. Tatum 615,322
Key fastener, A. E. Brockett 615,380
Knitting machine, G. E. Frink 615,584
Knitting machine attachment, F. W. Sumner 615,595
Lasting and sandpolishing, Eschenbach & Sielke 615,653
Ladder, J. A. Weston 615,512
Lamp, H. A. Brognard 615,244
Lamp, T. Langston 615,696
Lamp, alcohol, G. T. Sutterley 615,686
Lamp chimney, incandescent, O. Schott 615,578
Lamp, electric, M. S. Okun 615,407, 615,408
Lamp for incandescent lights, antivibration, G. S. Barrows 615,239
Lamp, incandescent gas, E. Lindner 615,586
Lamp, incandescent gas, J. Moeller 615,626
Lamplighter, time, N. Durant 615,588
Lead steaming machine, G. P. Butler 615,247
Lift or handle for boxes, cases, etc., detachable, T. Green 615,355
Lift, safety, M. J. Oliver 615,362
Lifter. See Truck lifter.
Lifting jack, J. C. Covert 615,433
Light. See Incandescent light.
Limb, artificial, F. V. McParlin 615,290
Linoleum, machinery for manufacturing, M. B. Nairn 615,631
Liquid raising apparatus, H. C. Sergeant 615,412
Lock. See Bicycle lock. Door lock. Permutation lock.
Locomotive and truck, electric, S. M. Vauclain 615,504
Locomotive, electric, M. E. Thomas 615,592
Log carriage steam feed device, C. Carlson 615,475
Loom, Crompton & Wyman 615,572
Loom attachment, J. Peltier 615,655
Loom shuttle, J. H. Morin 615,567
Loom temple, P. Duffy 615,536
Match box, stand, or receptacle having automatic striking action, R. L. Dunford et al 615,611
Match splint bundling machine, C. J. Donnelly 615,630
Matrix sheets, manufacturing, H. Schimansky 615,577
Measure, cloth, R. B. Luse et al 615,290
Measuring and delivering device, liquid, G. F. Barron 615,238
Measuring and marking length on fabrics, apparatus for, G. Newsum 615,406
Mill. See Crushing mill. Crushing and pulverizing mill.
Milling machine, C. G. Shedin 615,313
Mine trap door, A. Hurford 615,276
Mining dredge, I. Stead 615,414
Mining machine, Ball & Officer 615,236
Mirror holder, S. H. Clark 615,250
Mixer. See Air and gas mixer.
Moulding machine, L. Poole 615,574
Mop holder, C. W. Parks 615,410
Morpholin and making same, L. Knorr 615,488
Motor. See Car motor.
Mouse trap, M. J. Lawler 615,562
Mowing machine finger bar latch, J. Woods 615,334
Music book leaf turner, A. McRae 615,405
Music rack, J. Englund 615,480
Nailing machine, E. T. Freeman 615,481
Nozzle, shut off, W. F. Cunningham 615,434
Nut lock, J. C. Sattes 615,367
Offices indicator, C. Moore et al 615,568
Ore concentrator or placer mining machine, Brown & Steely 615,424
Ore washer, L. J. Mytinger 615,450
Package and grocer's caddy, convertible shipping, C. Toohey 615,324
Packing box, C. C. Mengel 615,294
Pad. See Coat pad.
Padlock, permutation, J. R. Brodie 615,525
Painter, pole, P. W. Meinecke 615,627
Pan. See Baking or roasting pan.
Paper box form, folding, F. W. Wilcox 615,417
Permutation lock, J. H. Parks 615,655
Pessary applier, E. A. Butler 615,425
Photographic shutter, J. A. Mosher 615,296, 615,297
Photographic shutters, device for pneumatically operating, Smith & Holborn 615,315
Pie safe or canister, J. W. Martin 615,457
Piston of nutating piston meters, J. C. Kelley 615,392
Planter, chopper, and cultivator, combined, N. Albrecht 615,668
Plastic material cutting table, A. Snell 615,582
Plow and stalk chopper, combination, Williams & Galbraith 615,335
Plow ditching attachment, L. U. Valentine 615,374
Plow fender, J. H. Taylor 615,586
Plow, wheel, W. B. Richards 615,462
Plow, wheel, M. & A. Sattley 615,310
Polishing machine, F. F. Ellis 615,385
Pool and billiard table, combined, V. Fountain 615,350
Post. See Binding post. Fence post.
Post driver, H. H. Whitener 615,330
Potato separator, D. E. Updegraff 615,325
Power. See Horse power.
Press. See Baling press.
Pressing machine, Lorillard & Tremaine 615,397
Printing machine, color, W. H. Waldron 615,506
Printing machine staple binding delivery mechanism, L. C. Crowell ..... 615,253 to 615,259
Printing press anti-offsetting apparatus, T. Regensteiner 615,636
Pulley, friction, J. Gillet 615,268
Pump connection, F. M. Stevens 615,509
Pump, force, H. Bender 615,470
Pumping apparatus, E. P. Williams 615,331
Puzzle, J. E. Sharpe 615,413
Puzzle bank, A. E. Brockett 615,381
Rack. See Music rack.
Railway gate, McGregor & Williams 615,402
Range, broiler, T. Guinean 615,548
Ratchet brace for screw drivers, etc., pocket, J. W. Dawson 615,649
Reel, E. H. Weaver 615,657
Reflector, A. E. Boeschenstein 615,471
Register. See Autographic register. Cash register.
Retort door, H. E. Davis 615,261
Revolver, A. C. Wright 615,467
Rheostat, C. Wirt 615,419
Rheostat, automatic, E. T. Wilkinson 615,418
Ring. See Curtain ring.
Riveting machine, hydraulic, E. Graves 615,547
Roadway, H. M. Williams 615,332
Rock drill, A. J. Bant 615,372
Roll, G. M. Pelton 615,411
Rosette cutting bit, A. W. Cooper 615,251
Rotary engine, D. M. Dearing 615,664
Rotary engine, J. C. Walker 615,597
Rubbing or polishing machine, Johnston & Sowers 615,621
Safe or vault, E. C. Shankland 615,503
Salt purifier, P. Yoder 615,335
Saw filing and setting machine, A. Keppeler 615,280
Sawmill carriage, W. Springer 615,587
Scale, asphalt, P. C. Brennan 615,423
Screen. See Fly screen.
Screening or bolting machine, F. Brandstaedter 615,524
Scythe, Baker & King 615,518
Seal, bottle, S. F. Estell 615,543
Seal, car, A. H. Peirce 615,461
Seat. See Folding seat.
Separating machine, J. Higginbottom 615,618
Separator. See Potato separator.
Sewing machine, H. Diamond 615,436
Sewing machine, E. Duplessis 615,263
Sewing machine gage, H. S. Shaft 615,469
Sewing machine thread controlling mechanism, R. G. Woodward 615,647
Shade holding mechanism, H. H. Forsyth 615,442
Shaft or thill coupling iron, Thompson & Rush 615,645
Sheathing, metallic, T. F. Hagerty 615,449
Shelf block case, hook, A. E. Foutch 615,545
Ship's log, J. L. Bliss 615,422
Shoe case, H. H. Driggs 615,438
Shower bath, E. Jendis 615,486
Signal system, block, W. L. Stockton 615,584
Signaling codes, indicating chart for marine, F. V. De Bem 615,604
Sleeping bag, R. O. Stebbins 615,642
Smelting furnace, H. Charlier 615,429
Smoke consumer, W. L. Dento 615,346
Smoothing iron, T. Hawkes 615,356
Snap hook, E. A. Cummings 615,345
Snap hook, G. M. Hubbard 615,556
Soap, etc., apparatus for moulding, A. F. & A. G. Beyer 615,421
Spectacles, G. W. Mansfield 615,624
Speeder machine, E. W. Houghton 615,555
Sprinkler. See Fire sprinkler. Fire extinguishing sprinkler.
Staging horse, W. Porten 615,364

(Continued on page 399)

Stamp affixing machine, R. W. J. Kraus	615,394
Stamp, ore, D. M. & J. E. Smyth	615,369
Stay bolt, A. Monell	615,628
Steam boiler, F. F. Birch	615,241
Steam boiler, W. C. Temple	615,644
Steam engine, J. Thom	615,371
Steam generator, J. L. Hastings	615,452
Steam generator, E. P. Lynn	615,489
Steam generator, J. A. Miller	615,458
Stocking, Hayden & Wurst	615,271
Stool, folding, J. L. Chapman	615,476
Stopper. See Bottle stopper. Bottle or jar stopper.	
Stopper for fixed washbowls, H. C. Cornelius	615,431
Store service apparatus stop mechanism, S. W. Barr	615,338
Stove, G. Nolte	615,300
Stove, W. H. Page	615,302
Stove, W. Thompson	615,415
Stove, sheet metal laundry, Morgan & Dunnagan	615,629
Stoves, warming oven for oil or vapor burning, A. J. Frank	615,267
Strainer, pot or kettle, C. Yeager	615,468
Strap. See Hame strap.	
Street sweeper, A. C. A. Dupuy	615,537
Sulky, G. Greutman	615,447
Suspenders, R. H. Branch	615,474
Switch. See Electric switch.	
Switch contact, M. Guett	615,665
Switch operating apparatus, electric, C. Hartdegen	615,388
Symbols, holder for designating, G. J. Blatter	615,341
Table. See Pool and billiard table.	
Tag, G. L. Reenstierna	615,637
Tannate and making same, orexin, H. Reinhardt	615,307
Telephone, Burger & Williams	615,344
Tent, H. O Flipper	615,544
Thill coupling, S. Gress	615,269
Thill coupling, J. A. Yarger	615,378
Thill coupling, antirattling, J. E. Whitney	615,513
Tile and tile setting, C. C. Alexander	615,515
Tire, pneumatic, T. B. Jeffery	615,484
Tire, pneumatic, F. W. Morgan	615,630
Tobacco leaf stemming machine, G. P. & W. H. Butler	615,248
Tongue, wagon, Sekora & Bartlett	615,501
Toy, automatic, W. H. Hyde	615,277
Track cleaner, L. R. Shell	615,580
Trap. See Mouse trap.	
Trimming, G. H. Taylor	615,324
Truck, G. J. Hafner	615,448
Truck lifter, W. J. Donaldson	615,534
Trunk hat holder or packer, G. M. Tinsley	615,593
Truss, H. Nerenz	615,491
Tub. See Wash and bath tub.	
Tubular boiler, J. J. Cain	615,661
Turntable, W. R. Miles	615,295
Type comb, W. Berri	615,340
Typewriting machine, A. T. Brown	615,343
Typewriting machine, C. D. Wallace	615,327
Typewriting machine paper holder and feeder, R. W. Shade	615,502
Umbrella rib tip cup, J. Allesina	615,516
Valve mechanism, mining machine, Ball & Officer	615,234, 615,235
Valve, pressure, T. A. King	615,623
Valve, self regulating, L. Hawkins	615,550
Valves, means for securing washers on plug, I. N. Glauber	615,616
Vehicle, T. J. Cox	615,531
Vehicle driving gear, motor, J. & B. Millot	615,360
Vehicle wheel, S. Carbary	615,426
Vehicles, variable speed and power mechanism for motor, Clough & Bush	615,430
Vending machine, automatic, N. Mereness	615,359
Ventilater. See Car ventilator.	
Wagon box clamp, M. A. Leiter	615,563
Wagon, dump, G. M. Wallace	615,598
Wash and bath tub, convertible, A. Schmid	615,499
Washer. See Ore washer.	
Washing machine, Murphy & Halferty	615,570
Water closet valve, D. T. Kenney	615,622
Waterproof fabric, J. H. Stevens	615,319
Water tube safety boiler, J. J. Blackmore	615,242
Weather strip, L. Ender	615,542
Weed cutting machine, D. O. Hite	615,553
Weeds, composition for killing, A. P. F. Gammack	615,444
Weighing machine, F. H. Richards	615,494 to 615,496
Weighing machine, automatic, F. H. Richards	615,493
Well fishing tool, oil, B. D. Thompson	615,589
Wells, etc., shot anchor for oil, C. A. & H. F. Straub	615,321
Wheat cleaner and heater, L. D. Bruemmer	615,382
Wheel. See Fifth wheel. Vehicle wheel.	
Whistles, means for operating steam, W. R. Lyons	615,398
Window cleaner's safety device, W. Rosengarten	615,498
Wrapping machine, J. F. Hargraves	615,650
Wrench, J. F. Strahle	615,643
Wringer, C. P. Searles	615,312
Wristlet, Heagle & Topp	615,389

DESIGNS.

Badge, A. A. McRae	29,754
Belt plate, L. S. Richardson	29,776
Binding, skirt, C. L. Sulzberger	29,778 to 29,781
Bread box, M. Cody	29,758
Broiler or toaster member, M. Neagle	29,759
Candle shade, H. Hohenstein	29,756
Dust guard section, J. S. Patten	29,768, 29,769
Fan, register, S. Tuttle	29,765
Game board, G. S. O'Flyn	29,774
Hassock, G. B. Bartlett	29,760
Hose supporter band or belt, S. A. O'Byrne	29,777
Impeller, J. T. Wilkin	29,762
Insulator, J. L. Morgan	29,782
Label, N. Witsch	29,755
Muff, M. W. Judenfreund	29,775
Pitcher, F. E. Burley	29,757
Seam rubbing tool, E. F. White	29,766
Syringe pipe, C. Sullivan	29,765
Table, F. Stewart	29,761
Tie plate or chair, J. L. Edwards	29,764
Type, font of, J. W. Phinney	29,773
Vehicle frame, L. H. Dyer	29,772
Wagon body, speed, W. B. White	29,771
Wheel, sprocket, F. E. Mathewson	29,770
Wrench handle, A. Vaughan	29,767

TRADE MARKS.

Albumin compound containing phosphorus, Farbwerke, vormals Meister, Lucius & Bruning	32,211
Anesthetic for ophthalmological purposes, local, Farbwerke, vormals Meister, Lucius & Bruning	32,210
Boots, shoes, and leather, Rice & Hutchins	32,199
Boots, shoes, and slippers, P. C. Saul	32,200
Chemical compounds, certain named, J. A. & W. Bird & Company	32,206
Cleaning compound or liquid, H. Stern	32,205
Coffee and tea, C. E. Moody & Company	32,202
Coffee, roasted, Goebel & Wetteran	32,203
Dung, artificial, Farbwerke, vormals Meister, Lucius & Bruning	32,212
Dyestuffs applicable in coloring and printing processes, Farbwerke, vormals Meister, Lucius & Bruning	32,209
Fire extinguishing chemical compound, P. C. Freet	32,207
Horseshoe nails, Putnam Nail Company	32,218
Medicine for wounds, Farbwerke, vormals Meister, Lucius & Bruning	32,213
Oil, olive, Chaffard & Conger	32,201
Pharmaceutical preparations, certain named, M. J. Oisen	32,208
Remedy, certain named topical, A. Camnitser	32,217
Remedy for a certain named disease, Farbwerke, vormals Meister, Lucius & Bruning	32,215
Remedy for certain named diseases, Farbwerke, vormals Meister, Lucius & Bruning	32,214, 32,216
Stationery, certain named articles of, Spencerian Pen Company	32,197
Watch movements, watch cases, and watch parts, New England Watch Company	32,198
Whisky, A. Overholt & Company	32,204

LABELS.

"Louvre," for cigars, H. Plagemann & Company	6,732
"Pour La Nobless," for cigars, American Lithographic Company	6,730, 6,731

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